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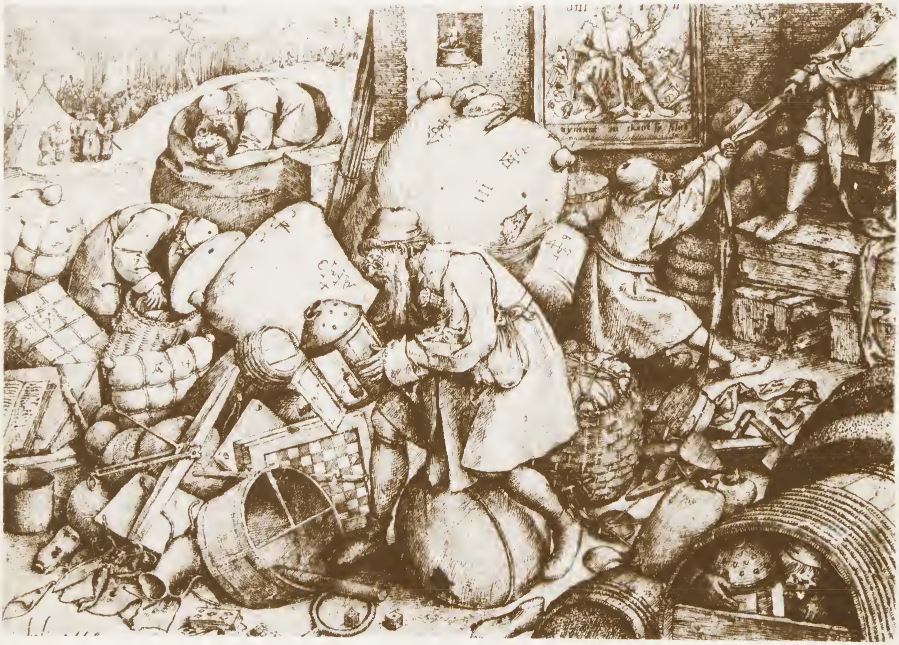

'ELCK OR EVERYMAN'
Pieter Breughel; 1558; pen and ink.
Courtesy, Trustees of the British Museum, London.

Review

2000 YEARS OF NESTED CUP-WEIGHTS

Very little has been published on this subject, in spite of the great interest created by nesting weights. Their history goes back to Roman times and from the Medieval period onwards, many examples have survived. Nesting weights, attractive and satisfying to handle because of their neat and precise fit, one inside the other, have been used as national standards and for weighing gold and silver, diamonds, grain, people and for apothecary and common trade purposes. The author traces their history, covering many aspects; national design characteristics, mass systems, materials, methods of manufacture, adjustment and stamping, and master-signs. There is a much needed chapter on the many fake weights now on the market, and a useful glossary of terms in English, German, French and Dutch. The book is profusely illustrated with both common designs and rare and exotic variations.

In view of the known difficulties in obtaining information about the history of English weights, it is not surprising that the English sections are somewhat sparse. It is, however, unexpected to find that the important Exchequer and Westminster verification marks, and their use, have been confused. Even more surprising, is the statement that "normal nested cup-weight are never made of bronze", which is, surely, contrary to the experience of most collectors of English nesting weights.

Once again, Dr Houben has provided an important and attractive work of reference, essential reading for all who are involved with nesting weights. The many photographs of master-signs are particularly valuable for research.

'2000 Years of Nested Cup-Weights' by G.M.M.Houben, 1984. Paper-back, 82 pages; 185 Figs (99 master-signs): Available from Dr.G.M.M.Houben, Hugo de Vrieslaan 12, 8024 BM Zwolle, Holland. Price, incl. postage, f38.50 on Postgiro No.415559, or f45.00 by International money order. (f = Guilders).

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Scales as Symbols

ELLEN ZAK DANFORTH

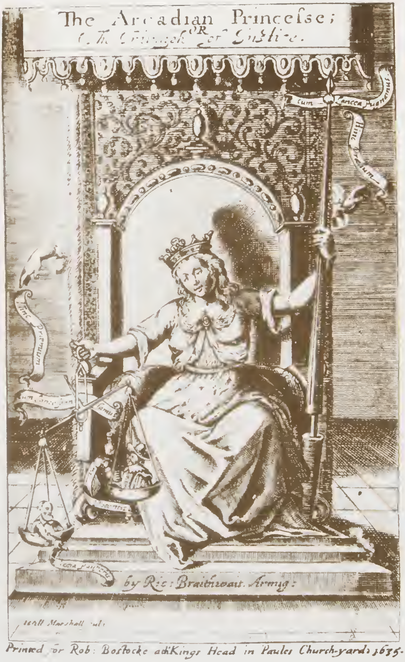
For centuries the scale has been the traditional symbol of justice and truth (1). The concept has been repeated so often that Dr. Edward Clark Streeter, founder of the Streeter Collection of Weights and Measures at Yale University, once remarked, "There is a mass (pun intended) of material at hand for any daring soul that undertakes to illustrate this use of a symbol in full development" (2).

While this article will hardly suffice as full treatment of the subject, it is hoped that it will show how varied is the artist's interpretation of truth and justice as symbolized by the iconographic use of scales. All of the examples shown here are from Dr. Streeter's collection of metrological ephemera; some, no doubt, are familiar, others, hopefully are not so much so.

JUSTICE

Always depicted as a woman, Justice holds a sword in one hand and a scale in the other. In the example from the frontispiece of Richard Braithwait's *The Arcadian Princess; or, The Triumph of Justice: Prescribing excellent rules of Physicke for a sicke Justice.* (1635),

'FULL WEIGHT AND QUALITY'
Worth Her Weight in Silver: Illustration by an unidentified artist.
Courtesy, Edward Clark Streeter Collection of Weights and Measures,
Yale Medical Historical Library, New Haven, Connecticut.

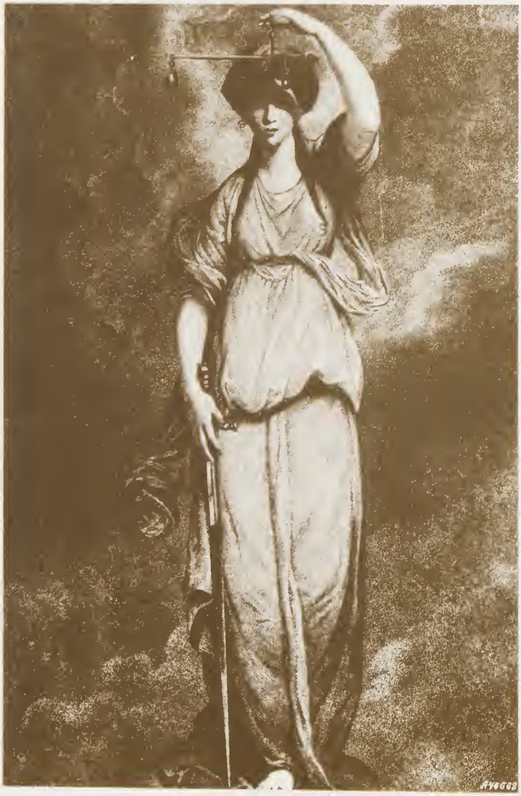

The Arcadian Princesse;
OR The Triumph of Justice.
cum Lancea Pugnemus
Hinc Praemium
Hinc Praemium
by Ric: Braithwait. Armig:
Will Marshall sculp:
Printed for Rob: Bostocke at ye Kings Head in Paules Church-yard 1635.

Frontispiece from Richard Braithwait's
'ARCADIAN PRINCESS: OR, THE TRIUMPH OF JUSTICE'
Courtesy, Beinecke Rare Book and Manuscript Library, Yale University.

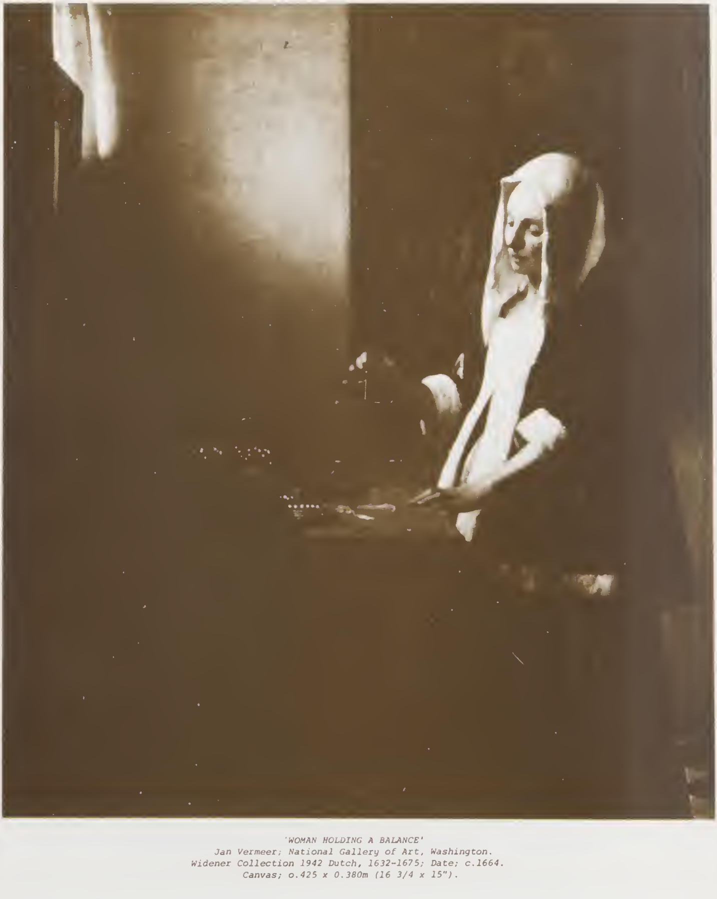
Justice holds a scale having two pans and an equal-arm beam. This type of scale underscores the theme of equality. In fact, from ancient to modern times, the "equal-arm balance" seems to be the preferred type of scale used by artists as a symbol (3).

One of the few exceptions is the Sir Joshua Reynolds *Justice* in New College at Oxford. Remarkably, in this illustration, she holds a Roman steelyard. Chosen by the artist because of a desire, during the 18th century, to paint classical things (4), the steelyard, with its unequal arm beam and only one pan, remains an imperfect symbol. One can only conclude that the personae of Justice is so well recognized that even if a cartoonist drew her sitting on a platform scale, the symbol would not be lost.

However, the figure of Justice appears also to symbolize the opposite of equality, that is, inequality. One could say that Reynolds chose a steelyard instead of an equal-arm beam for exactly that reason. Although it is normally said that the steelyard was used because it represents things classical, the equal-arm scale is, in fact, just as classical as well as more antique. It is also curious that Reynolds omitted the load pan or hook and instead, painted two nearly identical counterpoises, one balancing the other with much more leverage. It is possible that the artist was simply ignorant of the mechanics of weighing apparatus or it may be that he was more interested in the subtleties of iconographic imagery. *The Arcadian Princess*, as another example, shows a pauper in the heavier pan, while a figure representative of the powerful rich, in the other pan, looks down from his lofty point of (in this case) disadvantage (5).



'JUSTICE'
Sir Joshua Reynolds; (1723-1792).
Courtesy, New College, Oxford.



'WOMAN HOLDING A BALANCE'
Jan Vermeer; National Gallery of Art, Washington.
Widener Collection 1942 Dutch, 1632-1675; Date; c.1664.
Canvas; o.425 x 0.380m (16 3/4 x 15").

THE GOLDWEIGHER

Like the women called 'Justice', the women holding scales in seventeenth century Dutch genre painting also represent truth. The symbolism in these paintings, however, differs slightly from that in the Justice pictures. One Goldwagerin, illustrated here, is Jan Vermeer's *Woman Holding a Balance*. It is said that, because the woman depicted is pregnant, she uses the scale not as a weighing device, but as a pendulum to devine the sex of her unborn child (6). The truth-seeker in this case, then, is actually a fortune teller.

The subject of a goldweigher was a popular one in Dutch art because it also illustrated the concept of vanity. In Vermeer's painting there is an allegorical relationship between the action of weighing gold and the picture behind the head of the woman: 'The Judgement Day' warns the viewer that another sort of weighing awaits us all (7).

Pieter de Hooch, a contemporary of Vermeer, painted *Woman Weighing Gold* in much the same style (8). His painting, brighter in palette than Vermeer's shows walls covered with gilded leather instead of a picture of 'The Judgement Day'. De Hooch's interpretation emphasises opulence and is seen as a commentary on worldly goods (9). In his painting, symbol and theme are the same. In Vermeer's painting, the opposite prevails: with the emphasis on the spiritual, there is an intentional contrast between symbol and theme.

Male goldweighers prevail in the series of Dutch paintings called *Banker and his Wife*. Painted earlier than the women goldweighers, these paintings depict the 'banker' of the Middle Ages who was at once moneychanger, money lender, pawnbroker, attorney, accountant and receiver (10). The example shown here, painted in 1539, by Marinus van Reymerswaele, shows the banker testing the value of each coin by measuring it against a corresponding weight from the box. Although the profession was one that enjoyed a high reputation, bankers were not above criticism, and this painting, like the others in the series, suggests that usury was a common practice. In fact, some of the paintings in this series are titled *The Miser*. Whether usurer, miser, or diviner, the act of weighing was subject to wide swings of interpretation. One could make a false judgement as easily as a truthful one.

SAINT MICHAEL, WEIGHER OF SOULS

Less controversial than Goldweigher, is St.Michael, patron saint of many churches and the subject of much religious art. Throughout history, St. Michael has been known to fulfill several roles: In his struggle with Satan, St.Michael becomes the dragon-conquerer. On his visits to earth he assumes the role of warrior-protector. And as the receiver of human souls after death, St.Michael is the judge who decides whether or not they should be admitted to heaven (11).

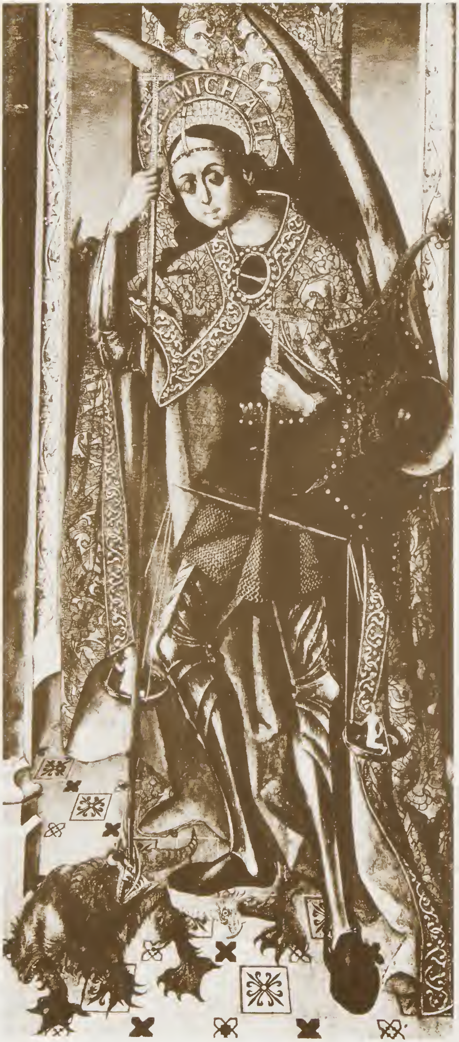
'BANKER AND HIS WIFE'
Marinus van Reymerswaele; 1539; original 83 x 97 cm.
Courtesy, Museo del Prado: No. 2567.

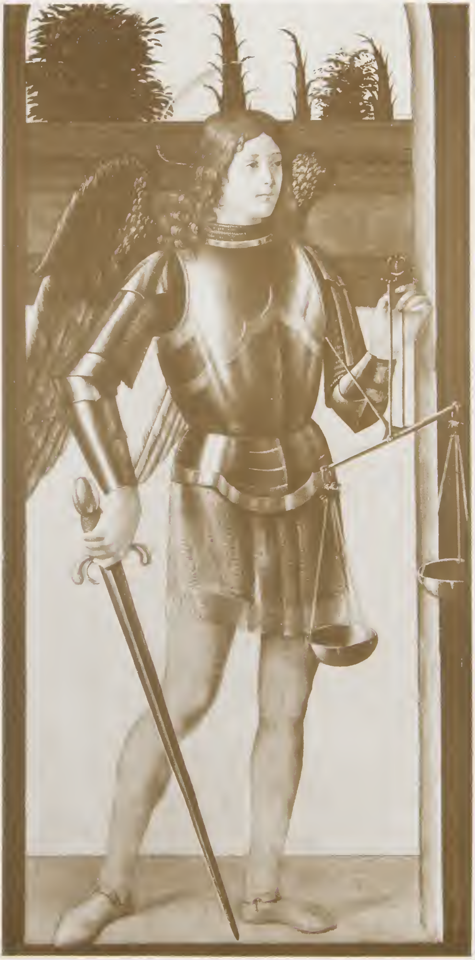
St.Michael's roles are symbolized in the three paintings shown here. In the 15th century *St.Michael*, attributed to Bartolome Bermejo, and in the 16th century *Three Saints*, the dragon, of course, represents the devil. Clad in armour and carrying a sword (in the Bermejo painting and in the 16th C. *St.Michael*, attributed to a follower of Ghirlandaio), St.Michael becomes the protector. In all the paintings, St.Michael holds a scale so that he may judge souls fairly.

The weighing of the soul as a symbol of judgement is an ancient idea that was used by the Egyptians in the Book of the Dead, long before Christianity began. In Greek mythology Zeus was responsible for weighing souls. The 'Weighing' took place during combat with victory being granted to the heavier (12).

Opposite

'SAINT MICHAEL'
Attributed to Bartolome Bermejo; 15th C.; Tempera on wood.
Courtesy of the Hispanic Society of America, New York.


MICHAEL



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The whole concept is, perhaps, best illustrated in *Three Saints*. The scale is clearly tipped in favour of the soul, represented by the figure in the pan to the right of St.Michael. (The right side of a saint is generally regarded as the place of honour). St.Michael emphasises the good of the soul by pouring purified water on the head of the figure. In the opposite pan, things of this world - such as building, land, and food - although piled high, do not outweigh the figure. In vain, the devil adds his whole weight to the pan trying to force it down (13).

ELCK, OR EVERYMAN

Greed does not have a chance of surviving in the presence of St.Michael, but in *Elck*, by Pieter Breughel, it dominates (see front cover). The idea is that 'everyman' - represented by the bearded figures in coats - seeks gain from the outward things in life but never bothers to think introspectively, (14). In this 16th century drawing, the composition is sated with symbolic images. The small picture in the background is a jester or fool, looking at his reflection in a mirror. The inscription below him, translated, reads: "No one knows himself."

The two figures on the right, pulling back and forth on a length of fabric, represent that aspect in man which always strives for the largest share. The lanterns that everyone carries emphasize the earnestness of man's quest for things.

The pile of goods that serves as the focus for everyone's search contains several symbolic items: The cards, dice and gameboard stand for avarice and desire; the mirror, vanity and insubstantiality; and the equal-arm balances represent equity or the absence of it, in a dishonest person.

Of particular prominence, is a large wooden dry measure of the sort once used to measure grain. The perpendicular bars discouraged one from over-measuring. A 'striking stick' (lying partially inside the measure), for levelling off the mound of grain, prevented carelessness or greed.

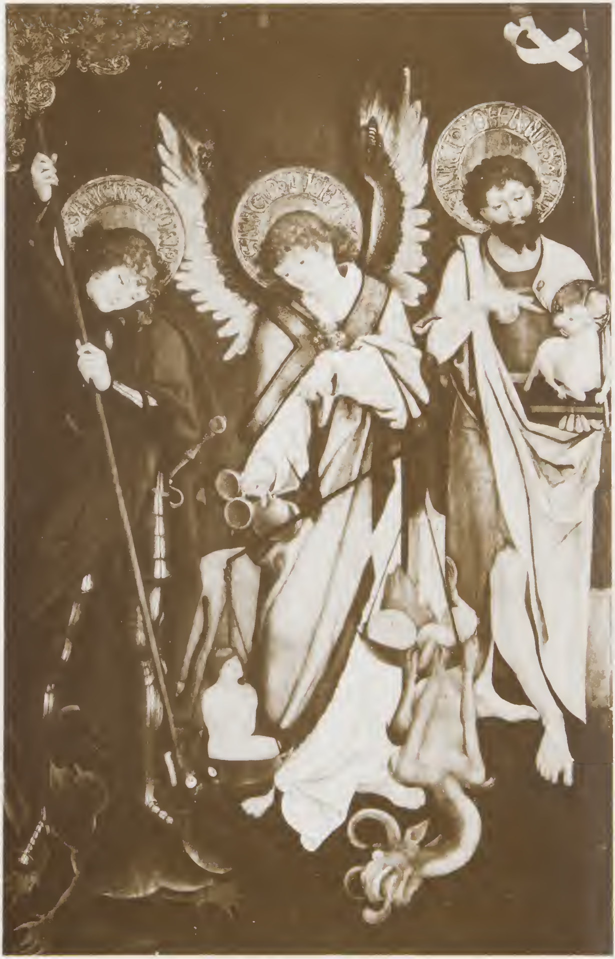
It could be said that these last two objects, the equal-arm balance and the grain measure, are the only optimistic symbols in the picture. Their prominence intimates the presence of hope for truthfulness in an otherwise faithless environment.

WORTH HER WEIGHT IN SILVER

Another kind of truthfulness is the subject of the idiom "worth her weight in gold". Considered by most people to be a complement, the phrase is a derivative of a legend in American folklore: On the occasion of his daughter Hannah's wedding, John Hull, Mint-Master and Treasurer of the Massachusetts Colony, paid a dowry by placing her on the scales and pouring out her weight in silver shillings (15).

Opposite

'SAINT MICHAEL'
By a follower of Domenico Di Tomaso Bigordi, called Ghirlandaio;
c.1500; Polychrome on wood; 31 7/8 x 15 7/8 in.
Courtesy, Samuel H. Kress Collection, Portland Art Museum, Portland, Oregon.



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However quaint it may seem, however, this scenario, as depicted by an unidentified artist, probably never actually took place. According to the bridegroom's ledger, John Hull paid his daughter's fiance a total of five hundred pounds. More precisely, sixty-five pounds of it was paid in shillings and four hundred and thirty-five pounds was paid later by transference to a new account (16). The five hundred pounds would have been equal to ten thousand shillings, or fifteen hundred ounces of silver, making Hannah's weight in Troy pounds, one hundred and twenty-five. This is not only a realistic figure for a girl of marriagable age, but it also indicates that the tradition of her dowry being worth her weight in silver was probably not far from the truth.

Ellen Zak Danforth is Acting Curator of the Streeter Collection of Weights and Measures, at Yale University.

FOOTNOTES

1. SANDERS L. 'A Short History of Weighing' W.& T.Avery Ltd. Birmingham 1947, p5. and VIEWEG R. 'Kulturgeschichte der Waage', Bizerba-Werke Balingen, 1967 pp.17-27.
2. Uncatalogued manuscript; Edward Clark Streeter Collection of Weights and Measures, Yale Medical Historical Library, New Haven.
3. See VIEWEG for a full treatment of the subject (1).
4. SANDERS (1) p.6.
5. I am grateful to Michael Crawforth for suggesting these aspects to me. The idea that symbols can have polar meanings in a single context is one of the more interesting aspects of iconographic study.
6. VIEWEG (1) p.64.
7. SLATKES L. 'Vermeer and His Contemporaries' Abbeville Press, New York 1981, p.56. and BIANCONI P. 'The Complete Paintings of Vermeer' Abrams, New York, 1967 p.92.
8. SLATKES (7) pp.7-12, and BAKER C.H.C. 'Masters of Painting: Pieter de Hooch' The Studio, London 1925, ,p.1. (De Hooch's 'Woman Weighing Gold' is not reproduced here because the scale in the picture is very difficult to see).
9. SLATKES (7) p.65
10. CUST Lionel, 'Notes on Pictures in the Royal Collections - XXIII' in Burlington Magazine, Vol.20, No.107. Feb.1912, p.252.
11. RUSHING D.B. 'The St.Michael Legends in Anglo-Saxon and Middle English' University of Illinois dissertation abstract, Urbana 1948, pp.1-9.
12. KISCH B. 'Scales and Weights' Yale University Press, New Haven 1965. p.3, 30, 34, 51. and VIEWEG (1) pp.11-12.
13. FOGG Art Museum, 'Collection of Mediaeval and Renaisssance Paintings' Harvard University Press, Cambridge, 1919, pp.267-9
14. LEBEER L. 'Catalogue Raisonne des Estampes de Pierre Brugel L'ancien' Bruxelles Biblioteque Royal de Belgique Albert 1er, Brussels 1969, p.76 and LUDWIG M. 'The Drawings of Breughel' Phaidon Press, London 1961 p.227.
15. CLARK H.F. 'John Hull, Builder of the Bay Colony' The Southworth-Anthoensen Press, Portland, Maine. 1940, pp.162-3.
16. AMERICAN ANTIQUARIAN SOCIETY 'The Diaries of John Hull, Mintmaster and Treasurer of the Colony of Massachusetts Bay' John Wilson & Son, Boston, pp.274-5. 1857.

Opposite

'SAINTS GEORGE, MICHAEL AND JOHN THE BAPTIST'
'Three Saints'; German (Franconian) First half 16th C.
Oil on panel; 76 1/8 x 48 1/2" (194.3 x 123.2 cm) 07.485
Gift of Edward W. Forbes 1907; Courtesy, Museum of Fine Arts, Boston.

Precision Balance 9

HANS JENEMANN

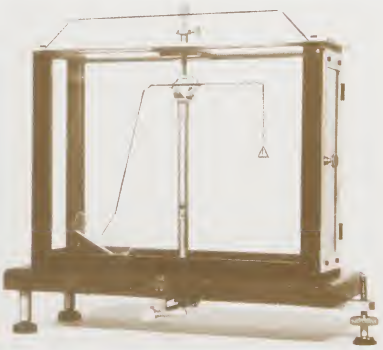


FIG 1.

The design of this micro-balance, Fig 1, is attributed to Walther H.Nernst (1864-1941), but it was made by Spindler & Hoyer in Göttingen, c1905. The balance was for weighing very small loads and was based on the principle of torsion combined with inclination of the beam. When the quartz beam was loaded, the glass rod twisted (a form of torsion spring) and the reading was indicated by the displacement of the long pointer against a graduated scale visible on the left side.

The beam, which is made of quartz, is only 1mm in diameter and has a length of 125mm (4.9"). On the left side, the beam is bent down to an angle of about 75 degrees and continues as the pointer 165mm long (6.5"). On the right, a thin wire suspends the pan from a little loop in the end of the beam. The pan diameter is only 10mm (0.4"). The beam is fixed, by shellac, to the middle of a thin glass rod 35mm in length (1.4"). This rod, which is the torsion element of the balance, is stretched between the arms of a fork at the top of the column, Fig 2.

When not in use, the beam is held by an unusual double arrestment gear, fixing from above as well as from below, Fig 2. When required for weighing, the upper arrestment is first removed using the device above the case. The locking screw is released, the vertical rod is pulled up by the knob on top, then the screw is re-locked. This raises the clamping fork clear of the beam, Fig 3.

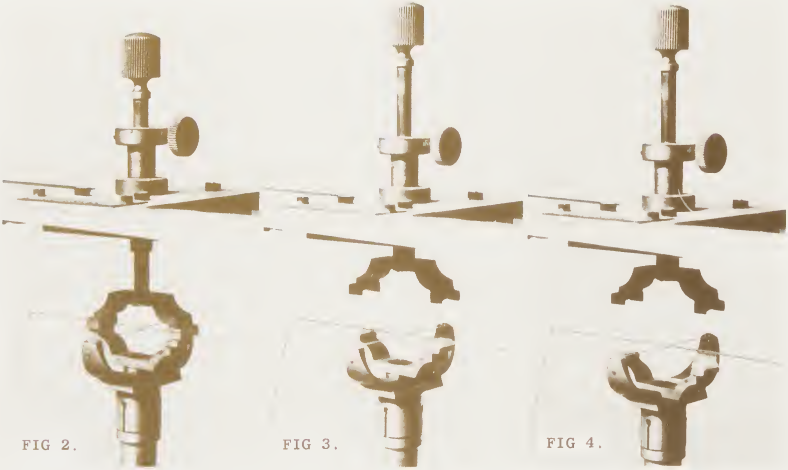


FIG 2. FIG 3. FIG 4.

FIG 2. The beam is arrested from above as well as from below.
FIG 3. The top clamp removed, but the lower arrestment is still in place.
FIG 4. The beam is fully free for weighing.

The second arrestment is the 'weighing arrestment', which is operated by a crank at the bottom front of the case. When the crank is turned to the left, the bottom fork is lowered away from the beam via a cam and spindle inside the column, Fig 4. This part of the arrestment is the normal 'parallel-arrestment' as used on a great many precision balances. (compare it with the 'swinging-arrestment' described in Precision Balance 5.).

When the little pan was loaded with the mass to be weighed, the glass rod was subjected to a torsional force (it twisted slightly), and the right side of the beam tipped downwards. The inclination of the beam was indicated by the pointer on divisions engraved on a mirror which eliminated parallax errors. Accurate readings were ensured by using a microscope focussed on the divisions. It should be noted that the divisions were not marked in units of weight, but only with an arbitrary scale. The balance was calibrated by using little weights, and the readings on the scale were given on a diagram. Thus, the weight was determined by reading off the diagram against the scale reading from the balance. The maximum load of this microbalance was 5mg, and the sensitivity was 0.002mg.

The case of the balance measures 280 x 85 x 265mm high (11" x 3.4" x 10.4"). Access to the pan is by a door on the right side. The black-painted brass frame is fixed to a slate baseplate and has an aluminium top cover.

The firm of Spindler & Hoyer in Göttingen was founded in 1898. They mostly made optical, mechanical and electrical instruments, but no 'normal' balances. There was a long established tradition in Göttingen of making scientific instruments of all kinds, and so there were good foundations for Spindler & Hoyer's products. The firm is still in business.

The term 'micro-balance' is not the name for a special construction of balance. It refers to all kinds of balances of small dimensions which were for accurately weighing little loads. Thus, there were micro-balances based on the principle of spring and torsion, inclination, electromagnetism and several others. Microbalances of this kind often had a very high sensitivity, the best a nanogram (10^{-9} or 0.0000000001g) or less. But, the resolution* was not very high, at the best 1:1,000 to 1:10,000. The most well known type of micro-balance, however, was the 'micro-chemical balance' used especially in organic analytical chemistry. This type had a lighter construction than the normal beam balance for analytical purposes and was usually equipped with a rider weight and with reading in the inclination range. In more recent times, it was also equipped with air-damping, optical reading devices, and fractional weight facilities, in the same way as macro balances. This type of micro-balance had a sensitivity of up to one microgram (10^{-6} or 0.000001g) and could be loaded up to 20 or 30 grams. Therefore they had a very high resolution of about 1:10,000,000.

** Resolution is the ratio between sensitivity and maximum capacity.*

Showcase

1. Bilateral pendulum letter balance 0 - 8oz. Brass and tinplate.

LOU UIT DEN BOOGAARD COLLECTION

2. Single pendulum letter and parcel balance, marked GIBBS & Co. L'POOL PATENT (Liverpool). 0 - 20oz and 0 - 7lb, with two settings for the clip/hook. See patent by Ragg, EQM pp 538 & 540.

BILL DONIGER COLLECTION

3. Kitchen spring balance marked Made in Czechoslovakia. 0 - 25lb. Cast iron case, lift-off tinplate pan.

MICHAEL CRAWFORTH COLLECTION

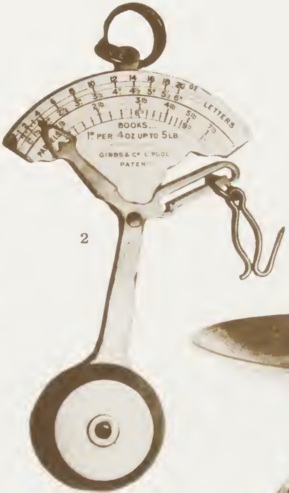
4. Pendulum grain scales, with the trade mark of Louis Schopper of Leipzig. Graduated 0 - 72 lbs per Imperial Bushel. Iron and brass.

MICHAEL CRAWFORTH COLLECTION

5.& 6. Iron weight of 2 lb, marked 2 ISW, with copper plug. Stone weight of 4 lb, marked 4. (ISW may be Imperial Standard Weight or a maker)

BOB HOLDAWAY COLLECTION

1



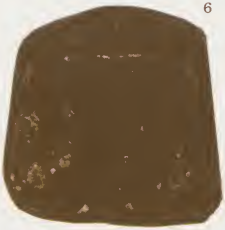
2

3

4

SHOWCASE

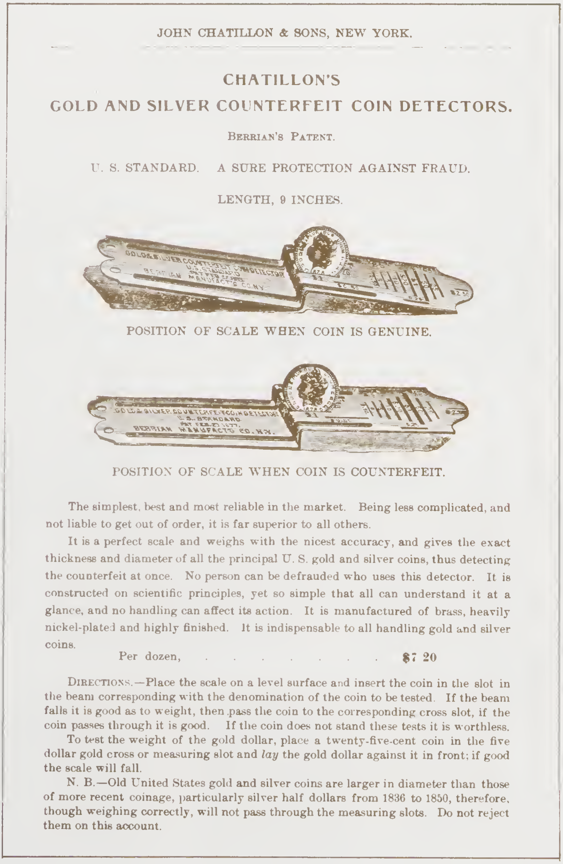
5



6

Old Advert

Sent in by TOD CARLEY


GOLD & SILVER COUNTERFEIT COIN DETECTOR
U.S. STANDARD
PAT. FEB. 27 1877.
BERRIAN MANUFACT'G CO. N.Y.
$1
$2 50

JOHN CHATILLON & SONS, NEW YORK.

CHATILLON'S
GOLD AND SILVER COUNTERFEIT COIN DETECTORS.

BERRIAN'S PATENT.

U. S. STANDARD. A SURE PROTECTION AGAINST FRAUD.

LENGTH, 9 INCHES.

POSITION OF SCALE WHEN COIN IS GENUINE.

POSITION OF SCALE WHEN COIN IS COUNTERFEIT.

The simplest, best and most reliable in the market. Being less complicated, and not liable to get out of order, it is far superior to all others.

It is a perfect scale and weighs with the nicest accuracy, and gives the exact thickness and diameter of all the principal U. S. gold and silver coins, thus detecting the counterfeit at once. No person can be defrauded who uses this detector. It is constructed on scientific principles, yet so simple that all can understand it at a glance, and no handling can affect its action. It is manufactured of brass, heavily nickel-plated and highly finished. It is indispensable to all handling gold and silver coins.

Per dozen, ... **$7 20**

DIRECTIONS.—Place the scale on a level surface and insert the coin in the slot in the beam corresponding with the denomination of the coin to be tested. If the beam falls it is good as to weight, then pass the coin to the corresponding cross slot, if the coin passes through it is good. If the coin does not stand these tests it is worthless.

To test the weight of the gold dollar, place a twenty-five-cent coin in the five dollar gold cross or measuring slot and *lay* the gold dollar against it in front; if good the scale will fall.

N. B.—Old United States gold and silver coins are larger in diameter than those of more recent coinage, particularly silver half dollars from 1836 to 1850, therefore, though weighing correctly, will not pass through the measuring slots. Do not reject them on this account.

Letters

Further to Lou uit den Boogaard's article on English postal scales (EQM page 683), I would like to make the following comments:

In my experience of Victorian robervals, it is quite common to find a matching set of stacking weights, where the 2oz is a very slack fit in the 4oz weight, and the 1oz rattles in the 2oz weight. Also, the fit of the weight in the base can be too tight or too slack. This can occur on the most ornate scales, where the heavy engraving of the 'A' frame and beam matches that of the weights. Similarly, on the more humble wood base scales, stacking weights marked 4oz/2d, 2oz/1½d, 1oz/1d, ½oz, ¼oz, although an original set, can be an appallingly slack fit inside each other and may not necessarily fit the base cut-outs, as well as one would expect.

With regard to the three bottle weights, Fig 7 page 689, although a full set is difficult to find nowadays, I would expect the set to continue as follows: 1oz/1d, ½oz, ¼oz, ¼oz, thus dating the scale for the 1871 period (1871-1897, Ed.) These weights were particularly used with Turner-construction wood-base scales ('A' frames 7B & 7D in my notes) often with Windle & Blyth's name on the beam. Regrettably, they are often removed by weight collectors and replaced by stacking weights, prior to resale. I would be extremely interested in seeing the 1920's/30's scale for which Lou's weights belong.

Do any members have scales with rates on weights for the periods other than 1871-97 and 1923-40 ? If Fig 2 on page 633 is, indeed, a 2oz weight marked 4d, as opposed to 4P, then the practice of stamping the old 'D' monetary value was operating prior to 1871.

Michael Robinson.

Notes & Queries

NQ 76 SPECIFIC GRAVITY BALANCE query from J.W.Piggott.

I read your article in 'Antique Collecting' on Grain Scales with much interest. I enclose a photograph of a curious instrument which might, perhaps, be a more recent version of these scales, and I would welcome your opinion on its intended purpose.

I found it in an unhappy state in a place best described as a marine store, it was clearly a single-pan balance with counterpoise and provision for a rider. Both pan and rider were lost. It could be from the 1930's, perhaps the 1940's ? The label indicated it had been supplied by the Boro Laboratories & Appliance Co.Ltd, Station Buildings, Catford, S.E. (I can no longer find any trace of them).

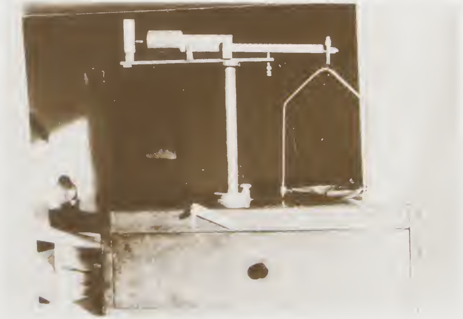
The drawer in the box is clearly intended to contain the instrument in a demounted state. The finish of the metal parts is good quality nickel plate. The length of the box is 13" (330mm).

My photograph shows the instrument in its tidied-up state; for the sake of completeness, it has been given a scale pan and the necessary support gear and suspension unit. But what on earth was it designed to do originally ?

REPLY from the Editor.

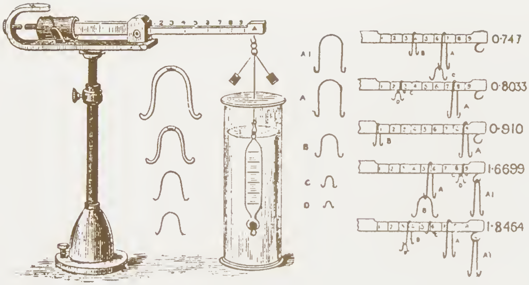
Your instrument is a specific gravity balance, of the Westphal type. It was used in laboratories for determining the S.G. of liquids. The beam end was fitted with a weighted glass plummet incorporating a thermometer (not a pan, as you show). A series of 'U' shaped weights were supplied which could be suspended from the beam, or from each other by means of the hooked ends of the 'U'.

In use, the plummet was immersed in the liquid and weights were placed on the beam to achieve equilibrium. The figures on the beam, where the weights were placed, gave the S.G. as illustrated in the extract from the catalogue of J.J.Griffin & Sons, c1913. I think your estimate of date is good.



ISASC Members please note: Mr. Piggott's photo illustrates the problems created by the failure to use a plain background, and would not normally have been published in EQM. I include it this time with a plea to everyone who kindly sends me photographs - PLEASE use a plain white background.

Advice and hints for photographing scales and weights were given in an article in EQUILIBRIUM, pages 363-372, - it is well worth the extra effort to get things right, and you don't need expensive accessories.



5622.

NQ 77 AE - WAGE (NQ 73) reply from Jan Wage.

If it is of any help to Dirk Schmitz: DRGM denotes Deutsches Reichsgebrauchsmuster (Industrial Design Patent); DRP denotes Deutsches Reichspatent (Technical Patent); A denotes Angemeldet (Request Deposited or Patent Pending).

In view of these indications, it seems reasonable to assume that A.E. is the scale maker's or manufacturer's initials, or otherwise patent or design protection would be nil and of no value.

The Imperial German legislation (not fundamentally changed in the Weimar Republic), in its wording of Dec. 7th 1923, reserves PATENTS for technical inventions, and DESIGN PROTECTION (Copy-right) for objects for daily use and for working tools of a special design. In business practice, makers and manufacturers applied for a design copyright in cases where patents were not granted, or when applying for them would be too costly.

Perhaps some German colleague knows more about the existence of this mysterious Mr.A.E.Wage? He is not an ancestor of mine, anyhow !

Showcase

»

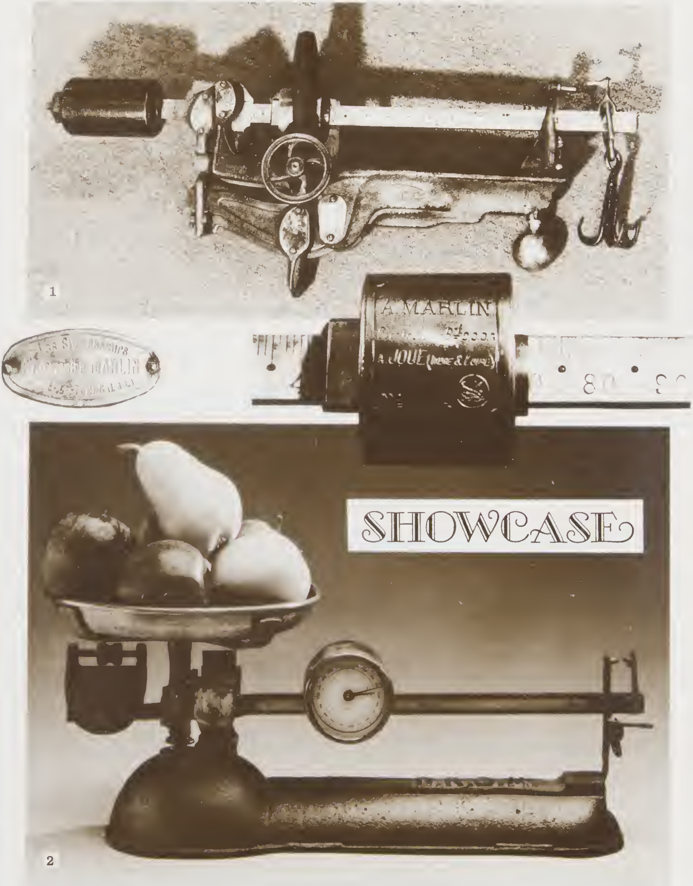
1. Butcher's steelyard of unusual construction, marked on the weight (see inset) A.MARLIN Constructeur Bt. S.G.D.G. a JOUE (Indre & Loire) No. 11244. A small plaque on the frame says; Les Successeurs d'Alexandre MARLIN Joue les Tours (I & L). Blade marked Force 1500kgm.

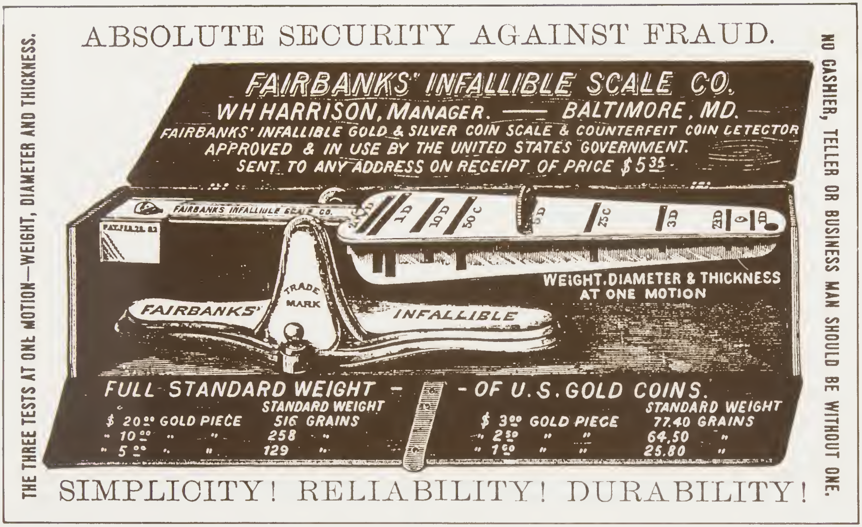
AIME POMMIER PHOTOGRAPH

2. Counter steelyard 450mm long (17.7") marked D.R.G.M. 0 - 5kg x 1kg and by 10g. The weight incorporates a dial with two pointers which rotate as the weight is moved along the beam, giving very accurate readings.

HERBERT GRIESHABER COLLECTION

SHOWCASE

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" 10.00 " "	258 "	" 2.50 " "	64.50 "
" 5.00 " "	129 "	" 1.00 " "	25.80 "

SIMPLICITY! RELIABILITY! DURABILITY!

THE THREE TESTS AT ONE MOTION—WEIGHT, DIAMETER AND THICKNESS.

NO CASHIER, TELLER OR BUSINESS MAN SHOULD BE WITHOUT ONE.

American CCD's

DON GORLICK

America's need for counterfeit coin detectors (CCD's) arose when the United States minted and used gold coins in 1795, and continued until the country left the gold standard, in 1933.

The intrinsic value of gold encouraged many enterprising methods of counterfeiting and debasing coins. Because the weight of gold coins cannot be duplicated, an adulterated coin that weighed correctly, had to be either thicker or larger in diameter, or a combination of both.

Drilling a small hole in the coin, hollowing out the centre, saving the shavings, filling the cavity with lead or mercury (both lighter than the gold removed), was the commonest method. This left a coin light in weight, but of proper thickness and diameter.

Splitting the coin, hollowing it out, then filling it to achieve full weight, resulted in a coin thicker, but of proper diameter and weight. Shaving the edge of the coin left a light coin, smaller in diameter, but of proper thickness. Dropping the coin in an electrolitic bath and removing gold by plating resulted in a light coin, thinner and smaller in diameter, and somewhat pitted. The electrolitic action transferred gold from the coin to a copper electrode from which it was later recovered for further counterfeiting activities.

As many of these counterfeits weighed the correct amount, scales alone were inadequate for their detection, as stated in the directions for Chatillon's Gold and Silver Counterfeit Coin Detector:

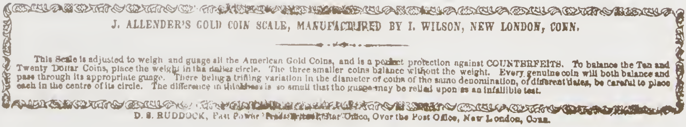
"The large amount of counterfeit United States coin in circulation (some two millions of dollars), besides the great number of genuine gold pieces made fraudulent.... are not deficient in weight, and can be detected only by the use of scales having both weighing and measuring slots carefully adjusted to each other, thus showing the slightest deviation in both size and weight."

Anybody could be caught-out by counterfeits, and the problem was not a local matter, but was widespread, as reported in the instructions for the M.B. Coin Scale Co.'s Gold and Silver Coin Tester and Counterfeit Coin Detector·

"Gold and Silver Coin being out of circulation for years, is now becoming the chief circulatory medium, and gives to Counterfeiters, and persons engaged in sweating, abraiding, filling, clipping the Gold and Silver Coins a field of operation which they have energetically used by issuing Counterfeit Coins, and sweating, abraiding, and making light the genuine coin in immense quantities."

In 1873-74, the silver content of U.S. silver coins was changed, and this seems to have stimulated the manufacture of detectors for heavy and light silver coins. (The author has several CCD's for silver dollars, halves and quarters, which originated in this period).

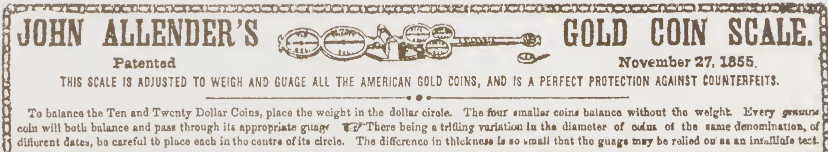
All this counterfeiting fostered the need for quick, handy, reasonably accurate and inexpensive detectors. The following is a selection of some of the rare CCD's, with illustrations and contemporary advertisements:-



J. ALLENDER'S GOLD COIN SCALE, MANUFACTURED BY I. WILSON, NEW LONDON, CONN.

This Scale is adjusted to weigh and guage all the American Gold Coins, and is a perfect protection against COUNTERFEITS. To balance the Ten and Twenty Dollar Coins, place the weight in the dollar circle. The three smaller coins balance without the weight. Every genuine coin will both balance and pass through its appropriate guage. There being a trifling variation in the diameter of coins of the same denomination, of different dates, be careful to place each in the centre of its circle. The difference in thickness is so small that the guage may be relied upon as an infallible test.

D. S. RUDDOCK, Fast Power [illegible] Star Office, Over the Post Office, New London, Conn.



JOHN ALLENDER'S GOLD COIN SCALE.

Patented November 27, 1855.

THIS SCALE IS ADJUSTED TO WEIGH AND GUAGE ALL THE AMERICAN GOLD COINS, AND IS A PERFECT PROTECTION AGAINST COUNTERFEITS.

To balance the Ten and Twenty Dollar Coins, place the weight in the dollar circle. The four smaller coins balance without the weight. Every genuine coin will both balance and pass through its appropriate guage ☞ There being a trifling variation in the diameter of coins of the same denomination, of different dates, be careful to place each in the centre of its circle. The difference in thickness is so small that the guage may be relied on as an infallible test.

FIG 1. Nickel-plated double-ended coin rocker, marked 'J.A.THOMPSON's INSTANTANEOUS COUNTERFEIT DETECTOR. PAT. APL.3.77 IMPROVED JAN. 5.78.' Slot gauges test thickness and diameter and also hold the coin for weighing. Genuine coins tilt the rocker to the left for 5, 2½, and 1 dollar, 20 and 10 cents. It tilts to the right for 20 and ten dollars gold, 1 dollar silver and 50 cents. An advert for this balance is shown above the figure.

A label on the original box includes the following directions:-
"Set the Detector on a level smooth surface, place one finger at the center while placing the coin to be tested in its proper slot, lift up your finger; if good, the Detector will tip; if bad, it will not. It is so simple that a child can use it. The rule is simply this, all good coin must ring, have the proper weight and thickness; if this is wanting, don't take it. Weight and thickness is detected instantly by my Detector."

"I have had one of 'Thompson's Counterfeit Detectors' in constant use for over a year past for testing the genuineness of gold and silver coin. I have never known it to fail in its instantly detecting a counterfeit coin, either silver or gold. It is the best thing of the kind I have ever seen, and invaluable to all who handle coin."
H.E.C.Daniels,
Teller, U.S. Sub-Treasurer.

RELIABLE AGENTS WANTED

Send one Dollar for Sample Detector.
J.A.THOMPSON.
Patentee and Manufacturer.
277, East Madison St. Chicago, Room 13.

FIG 2. Brass rocker balance for U.S. coins marked 'FAIRBANKS & EWING, PHILADELPHIA. Approved by the U.S. Mint.' Slot gauges test the thickness and diameter of the coins.

FIG 3. Two boxed rockers: Left, marked 'KRONENBERG's PATENT' The coin is passed through one of the slots on top of the box. A rocker beam checks the weight and, if correct, the coin rolls out of the end of the box. Right, marked 'PATENT APPLIED FOR.' The coin is tested first in the appropriate slot gauge, and then in one of the round holes on top of the box. A rocker beam checks the weight, and genuine coins slide out of the box.

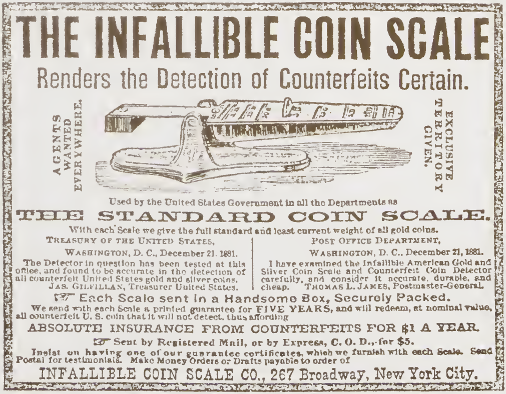
FIG 4. Brass steelyard type detector marked 'H.MARANVILLE's IMPROVED POCKET COIN TESTER. PATENTED FEBY. 14, 1860' The rectangular sheet brass telescopic weight slides in or out of the flat body. It is marked on the left with a scale of reference numbers for the weight. Across the rest of the face is a list of coins with the weight reference numbers, diameter numbers, thickness numbers and the value in U.S. currency. The figure shows the list of silver coins for the U.S.A. and several European countries. The weight slide can be turned over to use the weight reference numbers and list for gold coins.

The body of the instrument is marked with a scale of diameter for measuring the coin, and two tapered gauges for testing thickness. In this type of gauge, the coin is entered into the taper until it will go no further. The edge of a genuine coin should then be opposite its reference number. Pins projecting from the surface of the body locate the coin for weighing.

FIG 5. Brass rocker balance for 20, 10, 5 and 2½ dollars, marked 'MEYERS & CO. PHILA.' The coins are located and gauged in the slotted platters. There are two most unusual turn-over weights combined with further platters. These can be swung over the weight for weighing the larger coins, or swung over the large platters for weighing the smaller coins.

FIG 6. Plan view of the CCD's featured in Figs 1 to 4, showing the slot gauges and relative sizes.

This article was compiled by the Editor from a tape recording and with documentary material supplied by Don Gorlick. It heralds a forthcoming series on American patents for counterfeit coin detectors. Members are requested to send the Editor photographs of any American detectors for inclusion in the series - if you want well illustrated articles it is up to YOU to help.



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Renders the Detection of Counterfeits Certain.

AGENTS WANTED EVERYWHERE.

EXCLUSIVE TERRITORY GIVEN.

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THE STANDARD COIN SCALE.

With each Scale we give the full standard and least current weight of all gold coins.

TREASURY OF THE UNITED STATES, WASHINGTON, D. C., December 21. 1881. The Detector in question has been tested at this office, and found to be accurate in the detection of all counterfeit United States gold and silver coins. JAS. GILFILLAN, Treasurer United States.	POST OFFICE DEPARTMENT, WASHINGTON, D. C., December 21, 1881. I have examined the Infallible American Gold and Silver Coin Scale and Counterfeit Coin Detector carefully, and consider it accurate, durable, and cheap. THOMAS L. JAMES, Postmaster-General.

☞ Each Scale sent in a Handsome Box, Securely Packed.

We send with each Scale a printed guarantee for FIVE YEARS, and will redeem, at nominal value, all counterfeit U. S. coin that it will not detect, thus affording

ABSOLUTE INSURANCE FROM COUNTERFEITS FOR $1 A YEAR.

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Insist on having one of our guarantee certificates, which we furnish with each Scale. Send Postal for testimonials. Make Money Orders or Drafts payable to order of

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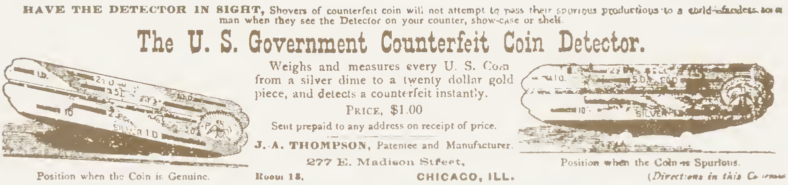

HAVE THE DETECTOR IN SIGHT, Shovers of counterfeit coin will not attempt to pass their spurious productions to a ~~could-fanders~~ to a man when they see the Detector on your counter, show-case or shelf.

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Weighs and measures every U. S. Coin from a silver dime to a twenty dollar gold piece, and detects a counterfeit instantly.

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Sent prepaid to any address on receipt of price.

J. A. THOMPSON, Patentee and Manufacturer.
277 E. Madison Street,
Room 18, CHICAGO, ILL.

Position when the Coin is Genuine.

Position when the Coin is Spurious.

(Directions in this C

FIG 1.

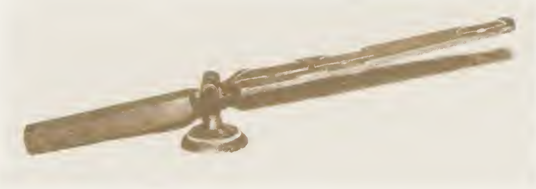


FIG 2.

FIG 3.

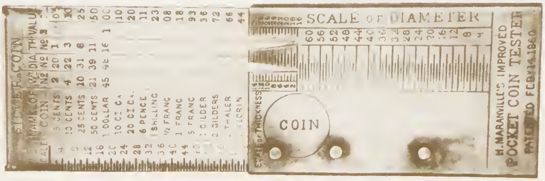


FIG 4.

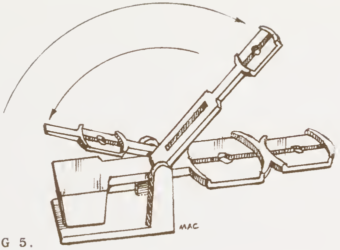


FIG 5.

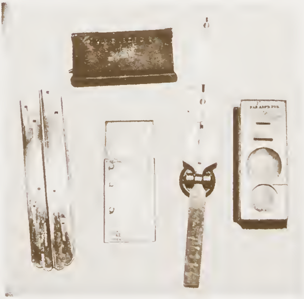
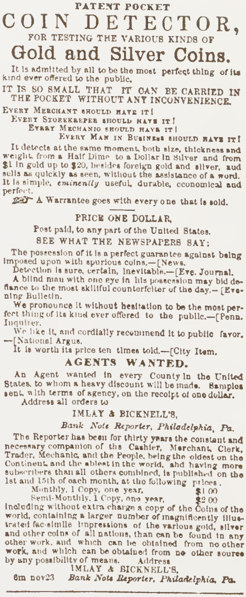


FIG 6.



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FOR TESTING THE VARIOUS KINDS OF

Gold and Silver Coins.

It is admitted by all to be the most perfect thing of its kind ever offered to the public.

IT IS SO SMALL THAT IT CAN BE CARRIED IN THE POCKET WITHOUT ANY INCONVENIENCE.

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EVERY STOREKEEPER SHOULD HAVE IT!
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It detects at the same moment, both size, thickness and weight, from a Half Dime to a Dollar in Silver and from $1 in gold up to $20, besides foreign gold and silver, and sells as quickly as seen, without the assistance of a word. It is simple, *eminently* useful, durable, economical and perfect.

☞ A Warrantee goes with every one that is sold.

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Detection is sure, certain, inevitable.—[Eve. Journal.

A blind man with one eye in his possession may bid defiance to the most skillful counterfeiter of the day.—[Evening Bulletin.

We pronounce it without hesitation to be the most perfect thing of its kind ever offered to the public.—[Penn. Inquirer.

We like it, and cordially recommend it to public favor. —[National Argus.

It is worth its price ten times told.—[City Item.

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IMLAY & BICKNELL'S,
6m nov23 *Bank Note Reporter, Philadelphia, Pa.*

LESS THAN PRECISE

Attention has been drawn to a number of errors in PRECISION BALANCE 7: The beam was divided into 100 parts for 10mg, making each part 0.1mg, not 1.0mg as inferred. Pierre Curie was responsible for the construction of an air damping system, his wife Marie, was not involved, and his arrangement had one cylinder fixed to the case and the other movable on the pan. The six swings referred to, up then down, were equal to three oscillations or cycles. The Editor apologises to Hans Jenemann for the errors due to some language difficulty on top of over-work!

ISASC

EQUILIBRIUM®

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

1985-ISSUE NO. 2

PAGES 765-792

Editor's Comment

In this issue, ISASC is honoured by the inclusion of an important piece of new research - the identification and interpretation by James E.Kelley Jr. of a medieval chart. Until recently, this old vellum chart was thought to show distances between the principal mercantile towns of Europe and the Eastern Mediterranian. It is now recognised as a wall chart showing equivalent weights and measures. Jim Kelley's enthusiasm is for the history and technology of late medieval cartography and navigation, so his study of the old chart started out as a search for contemporary cartographer's techniques and data for drawing nautical charts. Instead, his research shed more light on other business activities of chart-makers, and the needs of their customers.

We are indebted to Emil Cohn Jr. who asked for this special article to be written, and to the Geography and Map Division of the Library of Congress for their kind permission to include a reproduction of Domenech's chart.

Cover Picture

Since the 1890s, many different types of kitchen scales have been available to the British housewife. The Cover Picture shows just a few of the Varieties offered. At the rear is a hanging spring balance by Salter. Centre: a table steelyard, unsigned; 'Family Scale' by Emil Ubrig, Berlin, Imported; metric version of Harper's kitchen scale. Front: The Hilton Novobeam, pendulum balance; Imported Italian bismar ladle of the 1980s.

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Founded September, 1976

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Editor — Michael A. Crawforth	2 Field Close, Yarnton
Associate Editor — Diana Crawforth	Oxford OX5 1NE England

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Weighing in the Kitchen

(REPRINT FROM PETITE PROPOS CULINAIRE) MICHAEL CRAWFORTH

In the 17th and 18th centuries, wealthy English households included in their kitchen equipment "a beam and scales". In those days, the term 'scales' referred solely to the pans (Norse SCALA = pan), hence the later term 'a pair of scales'. In the late 19th century, scales came to mean the whole weighing instrument, and now we apply the term even to weighing devices without pans!

A 'beam and scales' had round copper pans suspended either by brass chains or by silk cords with tassels. They were hung from the extremities of a slender, polished iron beam with elegant swan-neck ends, Fig 1. The beam pivoted between two vertical iron legs joined at the top by an arch, (the shears or gallows). At the top was a wire ring and leather tab, so that the cook could hold it up by hand, or hang it on a hook at the edge of a high shelf. Weights, made of lead or bronze, were placed in one pan, then the ingredient to be weighed was put in the other pan until the beam reached equilibrium. Filling the pan, and emptying it into the mixing bowl, was hampered by the cords, which no doubt became thoroughly encrusted with particles of food. Using this type of scale was relatively slow, but gave accurate results.

Where large quantities of food had to be weighed, it was common to use a steelyard, Fig 2. A side of beef, for example, would be suspended from a sharp hook at the short end of the beam. Then the sliding weight was moved along the long arm of the beam, until it balanced. Weight value was then read off the graduations along the beam. The steelyard was a very practical instrument because one small captive weight balanced a greatly heavier load of food.

Weighing was a useful facility in big country houses where it was common to entertain varying numbers of guests with an adventurous choice of dishes. Precise flavours could be attained more easily by weighing than by empirical measurement. In less wealthy homes, where a more consistant number of people was catered for, and were the same simple dishes were cooked week in, week out, it was satisfactory to use 'a cupful', 'a handful' or 'a pinch'. Scales were not a necessity.

Of course, in shops, a great deal of food was sold by weight, as well as by number or by capacity measure. This requirement for weighing increased as Britain's trade and industry flourished in the late 18th century. Shopkeepers no longer had the time to be careful with cords and chains on pans, so their growing needs were satisfied by the scalemakers with a new design of instrument. Cords and chains were replaced, on the goods side, by a 'cranked hanger', which was a rigid rod bent down to one side of the pan, Fig 3. This gave open access to the pan, and the pan itself was made removable - two immense improvements in convenience. The scales could also be suspended from a pillar which was handily located on the shop counter. These improvements were soon made available for domestic use, and W.& T. Avery were illustrating such kitchen scales in their catalogue of 1830. Similar scales from their 1898 catalogue are shown in Fig 3.

FIG 1.

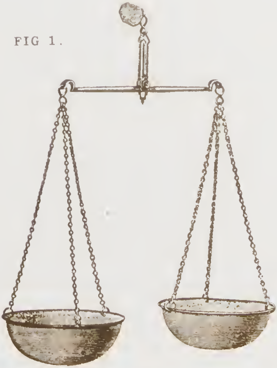


FIG 2.

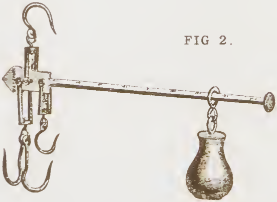


FIG 1. Traditional 'beam and scales with an iron beam and copper pans, and a leather tab to hold.

FIG 2. Standard pattern British steelyard used for many purposes. The 'ball' (or poise) was often painted matt red.

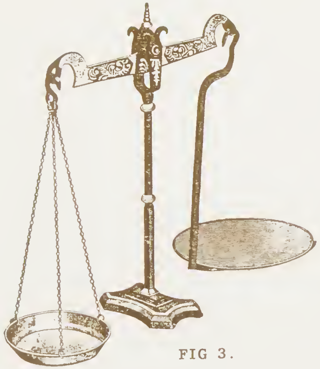


FIG 3.

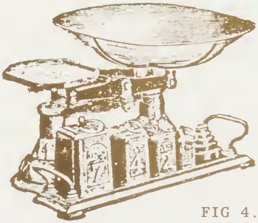


FIG 4.

FIG 3. Shopkeeper's counter scales adapted for kitchen use.

FIG 4. Roberval counter scale also adapted for the housewife.

In the mid 19th century, Britain's wealth continued to grow steadily. More food was imported and greater variety was available to feed the increasing population. Women's magazines, which many families could now afford, publicised new recipes. Adventurous cooking was encouraged by Alexis Soyer in his popular book *The Gastronomic Regenerator: a Simplified and Entirely New System of Cooking*, published in 1846. With such new and strange recipes, it was important to give more accurate quantities of ingredients, and in his book, Soyer frequently used weight as his definition.

Some years later, Isabella Beeton went even further. In *The Book of Household Management*, published in 1861, she insisted upon accuracy: *"In order that the duties of the cook may be properly performed, and that he may be able to reproduce esteemed dishes with certainty, all terms of indecision should be banished from this art. Accordingly, what is known only to him, will, in these pages, be made known to others.*

In them, all the indecisive terms expressed by a bit of this, some of that, a small piece of that, and a handful of the other, shall never be made use of, but all quantities be precisely and explicitly stated. With a desire, also, that all ignorance of this most essential part of the culinary art should disappear, and that a uniform system of weights and measures should be adopted, we give an account of the weights which answer to certain measures."

Mrs. Beeton goes on to say, *"Amongst the most essential requirements of the Kitchen are scales or weighing machines for family use."* This view is supported by illustrations of two scales, one the traditional 'beam and scales', the other a new design, invented around 1800 for the greater convenience of shopkeepers, Fig 4. This design, known as the Roberval system, had its pans above the weighbeam, so providing full unimpeded access to both weight pan and goods pan. Again, the goods pan was removable so that food could be conveniently tipped into a container. The great technical innovation which made this design possible, was the use of

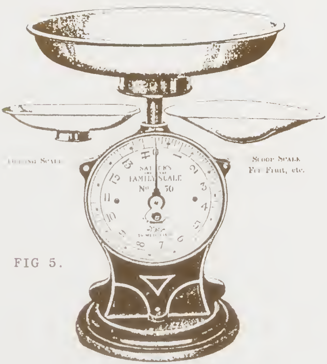


FIG 5.

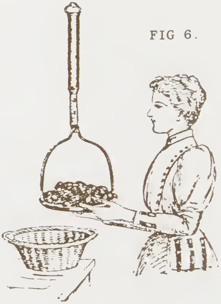
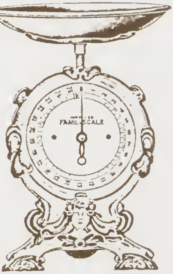


FIG 6.

FIG 8.



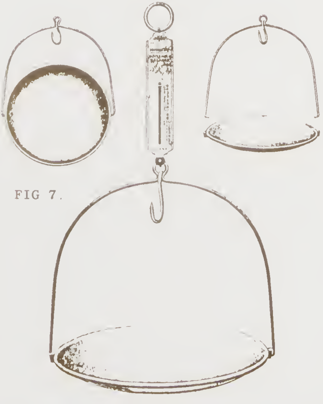


FIG 7.

FIG 9.

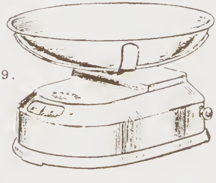


FIG 5. Salter's 'Family Scale' had three alternative pans available.
FIG 6. A hanging spring balance in use.
FIG 7. The pan tilted to lie flat against a wall, or could be removed to hang a bird, or other food, from the hook.
FIG 8. Dial-face balances were available with many different decorations.
FIG 9. Graduations conveniently faced the user on this Salter design.

vertical legs and horizontal stays below the beam. These formed a parallelogram arrangement of levers which held the pans horizontal. Scales of this type are currently enjoying a revival in Britain's kitchens with the use of renovated Victorian and Edwardian examples, and modern reproductions. Like the hanging pan scales described earlier, the Roberval provides accurate weighing, even of relatively small quantities, provided the 'knife edges' upon which the beam pivots, are in good condition.

In the 1869 edition of her book, Mrs.Beeton was even more emphatic: *"We commence our list with this most important kitchen utensil, as without a good set of weights and scales it is not possible to ensure success in cooking. Preciseness in proportioning the various ingredients, in order that no one particular flavour shall predominate, should be the cook's aim. We repeat, therefore, it is absolutely necessary to have scales, even if other utensils be dispensed with. The cook should bear in mind ALWAYS TO PUT THE WEIGHTS AWAY IN THEIR RESPECTIVE PLACES after she has used them, and to keep her scales in thorough order." "The price of a set of weights and scales, with weights from ¼ oz to 7 lb, is £1."* Her readers may well have been surprised by the strength of this recommendation, and have wondered whether commercial interests were behind it - she did mention one particular supplier, Richard & John Slack of the Strand, London, and gave their pricelist for kitchen equipment. However, her arguments for the use of scales have the air of conviction, and make scientific sense not necessarily convincing to those who consider cooking entirely an art form! The forcefulness of Mrs.Beeton's 1869 comments may simply have been the result of frustration caused by people ignoring her milder recommendation of 1861.

By 1890, over half-a-million copies of Mrs. Beeton's book had been sold, and over a quarter-of-a million of Soyer's book. The message about weighing for precise and consistant results was spreading far and wide. The firm of George Salter & Co. had already produced a new scale unsurpassed for speed and convenience. It was a spring balance with a dial face and a removable pan on top, Fig 5. No weights were needed, and the instrument gave an immediate read-out of the weight of goods in the pan. As with most spring balances, the accuracy was not as high as those scales which used loose

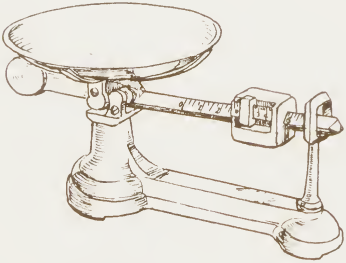


FIG 10. Table steelyard with a poise upon the poise.

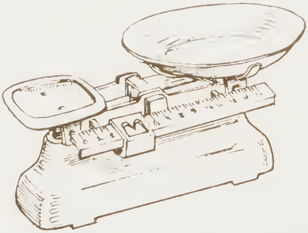


FIG 11. Combined roberval and steelyard side-beam.

FIG 12

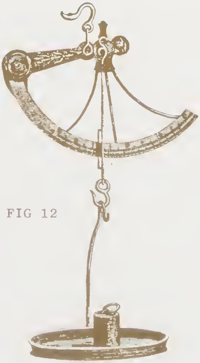


FIG 13.

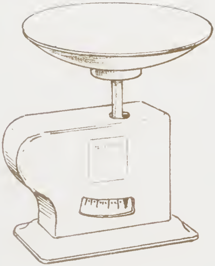


FIG 14.

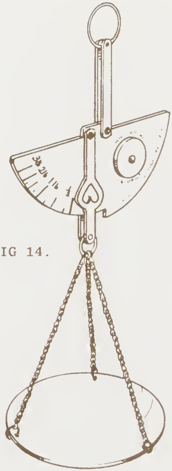


FIG 12. James Braby's pendulum balance of 1816 was an innovation, but it did not become popular.
FIG 13. Top-pan balance of the 1950's. The pendulum, hygienically enclosed, swings into the bulge.
FIG 14. Hilton 'Novobeam' reverted to a hanging pan.

weights. The accuracy was adequate, though, for cooking, except for very small quantities of a couple of ounces, or less. For the first time, some thought was given to the difficulty of keeping scales clean. The Salter design had all its mechanism enclosed in a casing which could be wiped. Food spillages falling into inaccessible parts of some earlier designs were not only unhygienic, but also could prevent the scales working properly.

Salter also made, for kitchen use, a spring balance with a pan hanging on chains, which could be suspended from a shelf, or hook in the ceiling, Fig 6. Another version had a rod hanger, which, with only two arms, provided less of an obstruction to filling and emptying the pan. In this design, the pan could be tilted through 90° to lie flat against a wall, Fig 7. Although less convenient than the dial-face type, the hanging spring balance had the advantage of cheapness, and it still provided rapid indication of weight.

So, at the start of the 20th century, housewives had the choice of hanging-pan scales, Roberval scales, and spring balances of two types. With the social upheaval, brought about by the first World War, more and more middle-class women were doing their own cooking. In country districts, the new bus services enabled housewives to do their shopping in towns, where a greater variety of foods was available and exotic imports could be obtained. This encouraged people to try new recipes and the demand for kitchen scales continued to grow.

During the 1920's, a great variety of kitchen scales became available. Salter's catalogue of the period included decorative variations of their dial-face balance attractively finished in copper-bronze or dark green with gold highlights. Low-priced alternatives were included in response to competition from foreign imports, notably a series of ornately modelled balances with a floral motif, cheaply made in Germany and Czechoslovakia, Fig 8. Reproductions of the Salter dial face balances are currently in the shops, although original examples may still be found, in good working order, at antique fairs, at prices lower than for reproductions.

The 1930's saw an increase in creative scale design, and new manufacturers appeared from outside the traditional scalemaking industry. Salter, aware of the awkwardness of stooping to read the vertical face of their balances, patented a new design, in 1932. It had a conical dial which rotated horizontally so that the face could point upwards towards the observer, and be seen through a window, Fig 9. This design was even more easy to clean, and was the forerunner of many later developments. In spite of the years of depression, the demand for Salter spring balances continued to grow. In 1934, the Company adopted flow-line production techniques and stepped-up its output of one model of kitchen scales to over 1,000 per day. This model was their No.46, a rather plain and highly practical dial-face balance with a lift-off pan generally similar to Fig 5. Production of other models continued, to satisfy customer's tastes for different designs.

It was during this period that the steelyard made a re-appearance, in a different form, suitable for use in a small kitchen. The steelyard beam was combined with half of the Roberval system to provide the convenient top pan while the weight, instead of being suspended, slid along the graduated beam, Fig 10. A similar sliding weight was also combined with a full Roberval system, patented in 1935, Fig 11. Here, weights were added in increments of one pound, to the weight pan, while the sliding weight measured in ounces and quarter-ounces.

One minor disadvantage of the steelyard is that any food spilled onto the beam near the end, causes a significant error - a fact my wife quotes to me when recipes don't turn out as they should!

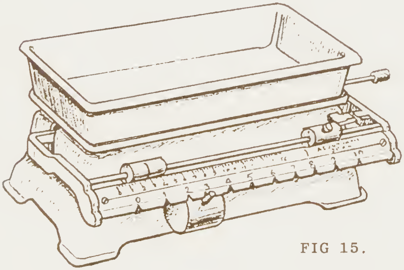


FIG 15.

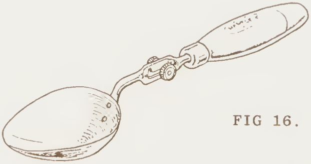


FIG 16.

FIG 15. Combined platform and steelyard - accuracy and convenience.
FIG 16. Bismar weighing spoon.

Another application of the steelyard was patented in 1935. It adapted the industrial platform scale for domestic use, Fig 15. A rectangular pan was supported above a complicated system of levers inside the case. An arm projecting through the front had, attached to it, a steelyard arm with two parallel beams. One beam, with a large sliding weight, adjusted the weight setting in steps of one pound. A smaller weight, on the second beam, read in ounces and quarter-ounces.

The steelyard represented a good compromise in terms of accuracy. It was quicker to use than loose weight scales, but was more precise than springs or pendulums.

The coming of the second World War put an end to inventive scale manufacture for a few years, but weighing was still important in the kitchen. Strange new recipes sponsored by the Ministry of Food, combined with the need to stretch food rations as far as possible, made scales a necessary part of wartime cooking. Shortly after the cessation of hostilities, manufactureres were able to return to new scale design.

One post-war idea was the re-introduction of the pendulum, or inclination balance, for domestic use. This principle was first advocated for scales by Leonardo da Vinci, but the first practical balances seem to have been made in 18th century Germany. It appears that in England, James Braby, of London, was the first to use the pendulum principle for kitchen scales, in his wood and iron balance of 1816, Fig 12, but it was not popular.

A pendulum balance is self-indicating and, like a spring balance, it needs no loose weights. When goods are placed in the pan, a pendulous weight, fixed to the end of an arm, swings outwards and upwards. The heavier the load, the further up it swings, until equilibrium is reached, giving rapid read-out of the weight. In the Kitway kitchen scale, patented in 1945, Fig 13, the pendulum weight swings up into the bulge on the left of the casing, and the weight is indicated in the window on the front.

Two years later, the same principle was used for the Hilton Novobeam, Fig 14. This design combines the weight with the dial face, so it is the face which swings up to balance the load. The weight is indicated by a fixed pointer on the suspension shears, against graduations on the face. As with spring balances, the pendulum provides speed and convenience, but only by sacrificing precision, particularly for small quantities. The Novobeam must have been a nuisance to the cook, as it reverted to the early method of hanging the scale on a shelf or hook, and the pan was permanently attached by its chains. Perhaps that is why only one surviving example is known to the author!

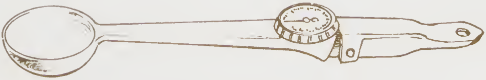


FIG 17. Spring weighing spoon, plastic.

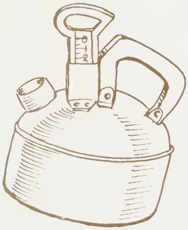


FIG 18.

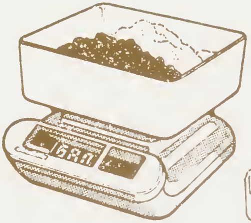


FIG 19.

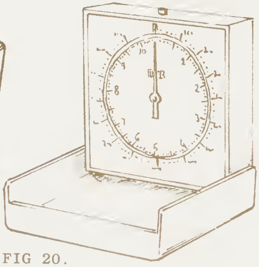


FIG 20.

In an attempt to overcome the problem of weighing small quantities quickly, the weighing spoon was devised. The Hartley spoon was patented in 1945, Fig 16. A small pivot pin was contained in a slot in the handle. With the pin at one end of the slot, held between finger and thumb, the spoon weighed a load of half-an-ounce, and at the other end of the slot, one ounce. Another design utilised the versatile spring. The spoon handle was in two parts connected by a hinge, Fig 17. When food was scooped up in the spoon, the bowl end of the spoon tipped slightly down, deflecting the spring and operating the weight indicator, a small dial on the handle.

For slightly larger quantities, the weighing ladle was available, to weigh up to eight ounces. Patented in 1954, it worked on a similar principle to the spring balance spoon. Other variations were also made. In practice, these devices were no more accurate than the larger spring balances, due probably, to cheap manufacture.

Economy in the use of heating was also considered in the weighing kettle patented in 1958. Again, the ubiquitous spring was chosen as the weighing element, made as an integral part of the handle, Fig 18. The kettle was suspended from the forefinger by the front loop of the handle.

In recent years, electronic digital read-out kitchen scales have been added to those mechanisms already described, Fig 19, but inside the casing, the basic principles remain the same. Spring mechanisms are the most common, and easy-to-clean plastics have replaced the cast and pressed metals of the past. There are clever wall-mounted designs with fold-up pans, Fig 20, and space-age styling, but the accuracy seems to have declined considerably since Mrs.Beeton's day.

For the last four decades, every recipe writer has assumed the ownership of scales by every reader, and assumed a working knowledge of the Imperial system of weights. The current confusion, with metric and Imperial systems both being indicated, will, hopefully, soon be over, leaving the Imperial system as an amusing, difficult, antiquity to puzzle our grandchildren. But kitchen scales will stay with us, probably operated by load-cell weighing elements and a small electronic chip. Will they, too, become collector's items ?

This article first appeared in PETITE PROPOS CULINAIRE, Aug.1984.

Medieval Weights & Measures

A 15th CENTURY WALL CHART

JAMES E. KELLEY Jr.

The large drawing on vellum reproduced in this issue of Equilibrium has been something of a mystery to scholars. Since it was first catalogued by Uzielli (1882) it has been thought to be a collection of geographical distances between ports, for use in making a nautical chart (1, 4). But, if you can understand Catalan, the whole story is right there in the legend at the top - upside down in the tab. It reads:

> *"Here in these presents, arranged by country, are the equivalent weights and measures between the ports shown, which are the principal regulated markets; arranged and made by me, Arnaldo Domenech, apprentice to Petri Rosell, 1484 AD."*

Next to this colophon is pictured the walled city of Siena with all its 15th century campaniles - the Sena Julia of Roman times. It is this decoration that suggests Domenech made the chart for a Sienese client, though there's not a weight or measure included for Siena.

Domenech and Rosell were important mapmakers of the time, with professional links that connected back through 100 years of Catalan cartography. The only other known work by Domenech is a nautical chart, date-marked "Naples, 1486" (National Maritime Museum, Greenwich). But there are a dozen, or more, surviving charts by Rosell. An interest in old nautical charts is what started my romance with Domenech's wall-chart of weights and measures.

Between 1484 and about 1870s we know nothing of the chart's provenance. At this time it was owned by the Marchese Gerolamo di Colloredo, Udine. Again, there is a lapse in our knowledge until the Library of Congress bought it in Munich, in 1914. Today you can see it in the Map collection of the Library of Congress.

The chart is about 376 x 597mm (14.8 x 23.5"), cut with a tab (the so-called "neck" typical of contemporary nautical charts) at the top. It was still attached to a wooden spindle (the nail holes are visible at the bottom) when the Marchese owned it. When not in use, the chart was rolled up and tied with a ribbon, and stored in a metal can. The tapered tab prevented the top corners from catching and tearing.

There are two (water?) stains in the upper left side, obviously caused when the chart was in rolled condition; and if you look closely at the bottom right-hand corner you can see scores of punctures where the owner, long ago, pinned the chart against a wall while it hung from a nail, tied there by the ribbon in the tab.

The first thing you can do with this chart is measure the lengths of things - principally bolts of cloth. The tick-marks all around the edges mark off half-lengths of various cloth measures used in the 15th century. If you look closely at the borders, you can see the names of these units of measure. There's the *bras* (arm's length), the *cana* (rod or cane), the *alna* (elbow or ell), the *pich* (Turkish pik), and the *gua* (an ell measure of Genoa and Catalonia). The English half-alna measures about 18 inches on the chart - just half of our familiar yard.

These measures of length are given for 19 different Mediterranean and North European markets. Incidentally, physical measurements of the distance between tick-marks suggest the vellum of the chart may have shrunk by over half an inch (12mm) in the past 500 years.

In the body of the chart, you see many circles connected by lines. The circles represent the 27 regulated commercial ports mentioned in the colophon. Only 16 of these names are in common with the cloth measure. Domenech gives us a picture of each market town within the inner circle. A heraldic banner - the town's colours - hangs from each town.

The relative positions of the vignettes are as follows, with their names transcribed into modern spellings:

England	**Bruges**	**Avignon**	**Marseille**	**Genoa**
Montpellier	**Toulouse**		**Sardinia**	**Pisa**
Perpignan	**Barcelona**		**Sicily**	**Naples**
Tortosa	**Majorca**		**Tunis**	**Venice**
Valencia				**Constantinople**
Seville		**Rhodes**		**Candia (Crete)**
Alexandria	**Acre**	**Damascus**	**Beirut**	**Cyprus**

Typically, the vignettes fall into two classes. The single-towered prototype is common to Catalan map decoration. The six-towered prototype with connecting walls is a particularly common feature of Rosell's charts. Domenech uses this multiple tower form for depicting the more important markets of the chart. ▷

Courtesy the Geography and Map Division of the Library of Congress
Washington D.C. U.S.A.

However, some towns are rather realistically drawn - as if Domenech actually saw them. Look at Barcelona with its turrets, battlements and gable-roofed buildings. The mole of the port extends to the viewer's left, in bent-finger fashion, a light tower balanced on its tip. A similar aspect of the port can be seen in early drawings of the city.

The vignette of Naples shows even more. It compares well with the painting "Fleet of Ferrante I in the Bay of Naples" (Museo di San Martino, Naples), which depicts the victorious Neapolitan fleet returning from the battle of Ischia, in 1464, under the Aragonese banner. It is easy to identify the port's lighthouse, the king's home Castle Nuovo (surmounted by a windvane in the form of a boat), and the gable-roofed cathedral with its rose window.

The three towers of Tunis' vignette can be seen across the lagoon from La Goulette in a Vermeyen tapestry of 1535. It looks like a fortified gate to the city from the sea.

The special vignettes, and other evidence, hint that Domenech operated a branch of Rosell's firm in Naples. At the time, southern Europe was in the midst of a depression. Demand for Rosell's products from mariners stopping at Majorca probably fell off, making a foreign branch more attractive. Since Siena and Naples were allies against Florence only a few years earlier, in 1479, Domenech was probably exploiting trade ties between the cities when he made this chart.

Notice how the circles surrounding the vignettes are connected to one another. The numbers and other signs seen in the chart state how weights in one market relate to the market on the other end of the line. There are 117 of these relationships. A modern day paraphrase of these equivalence statements might read "100 lbs in New York is equivalent to 45½ kg in Paris". But, at that time, merchants had many more systems to deal with, not just the British and Metric systems we contend with today.

To be more specific, look at the flag of Barcelona. Just to its left side is a strange sign that reads "qin" for 'quintal' or 'cantar', a hundred-weight unit (adapted from the Arabic qintar). To the right of the flag read "104 L", i.e. 104 libbre or pounds. The "L" looks something like a Greek "delta". All these signs mean is that in Barcelona, at that time, the commercial quintal weighed 104 local pounds. The extra 4 pounds was probably a built-in tret, an allowance made for waste, damage, or deterioration during shipment.

Notice that the quintal of Toulouse (located just above Barcelona in the chart) is 100 pounds, no tret being included. At the end of the line joining Toulouse with Barcelona, it reads "1 qin 2". This simply means the quintal (i.e. 100 lbs) of Toulouse is equivalent to one quintal and two pounds (i.e. 104 + 2 = 106 lbs) in Barcelona.

If you scan the chart you'll see other variations on the local weight of the quintal. For instance, at Genoa and Pisa, it weighed 150 pounds. And at some places, instead of a pound weight, they used another unit, the 'rotoli' (from Arabic ratl), abbreviated to "Ro". A summary of this chart is given in the table.

Notice that the chart defines two quintals for Valencia, one of 120 pounds, the other of 144 pounds. Most other cities had two systems of weight, too. The light (sotil) weights were used for spices and other high-value trade goods. The heavy (gros) weights were used for the more common goods. Domenech's chart refers principally, though not exclusively, to the sotil weights of the spice trade.

Spices included many things besides those we think of today. There were silk and cotton, sugars, waxes, nuts, dates, a wide range of chemicals, precious metals, coral and amber for jewellery and rosaries, and so on. Pepper from Egypt was an important item. It was shipped in baskets called "sporta". You can see a pepper pod in the chart where the 'sporta' of Alexandria is noted.

There are a variety of other types of weight indicated for Alexandria (lower left corner). See if you can make them out in the reproduction as you read along.

Materials sold *a la forfori* (= Arabic fulful, 'pepper') were ginger, frankincense, some ingredients for dyes, perfumes and medicines, quicksilver, ivory - fairly expensive materials sold in small quantities. The *gerui* (misspelled *ienoni*) weight (= Arabic djarouy) was used for some bulk foods (dates, honey, olive oil, raisins, rice, nuts, sugar) and chemicals (alum, wax, sulphur, resins, nitre, pitch, white lead), as well as some processed materials (soap, smelted metals, starch). The *leuedi* (*lendri* in the chart) weight (= Arabic layty) was used for flax and safflower. Finally, the *mene* was used to weigh such thing as cinnamon, cloves and clove stalks, nutmeg, China rhubarb and saffron.

In a sense, Domenech produced an inferior product. A computer-based study of his data indicates some 16% of the equivalent weight information is incorrect or missing. The table (page 783) shows the numbers of equations for each city in the analysis, and the number of them which were in error. These errors are all traceable to copyists blunders - single incorrect digits, or the addition or commission of digits, or the interchange of adjacent digits.

The existence of errors did not appear to bother the user too much. Apparently, his trading world did not include places whose weight equivalents are incorrect. Half the errors involve markets of the Levant under Ottoman or Mamaluke rule for many years before 1484. These places had restricted trade with the West. Other towns, like Avignon, Pisa, and Perpignon, for which errors occur, were down on their luck economically, in the late 15th century. The people of Perpignan were long ago known as the "rat-eaters".

However, some errors in the chart were corrected. The original equivalents for Barcelona and Majorca with Rhodes, have been erased and replaced; and in the weight equivalents for Majorca and Acre a "6" is overwritten "5".

A comparison of the gram weights implied by Domenech's chart and published weight values of surviving weight examples (see table) indicates the chart data is not too bad, after all. It is within a few percent, in fact. The really large deviations may be due to errors in identification of the examples. Or, perhaps these examples represent different standards to those in use when Domenech's source was compiled.

An analysis of these errors suggests that Domenech's source was at the end of a chain of from 15 to 30 re-copyings. This possibility could easily put their origin back into the 13th century, or earlier.

Other details also support the great age of some of the chart's data. An item of interest is the *pich de mito de xin* located at the centre of the left edge. It is probably a cloth measure on which a toll or duty had to be paid. The toponym *xin* is probably Kiev. The 'x' is either Greek 'kai' or the shushing palatalized sound of the Arabic 'shin' common to Iberia, both of which can be spelled 'ch', with either a hard or soft 'c'. The 'n' of *xin* is probably intended as a 'v', which looks like a 'u' in the contemporary round Gothic script, and which is also often mistakenly written as an 'n'. Upon substitution, *xin* becomes 'chiv', which is similar to 13th and 14th century spellings of Kiev, viz 'china' and 'chive'.

Kiev's golden age was back in the 11th century, when it was on a major trade route between Western Europe and Byzantium. Before the middle of the 13th century, the Mongols cut off this trade route. So, it is curious that Domenech had this information about Kiev in the late 15th century. Pegolotti's encyclopedic merchant's manual, written some 150 years earlier than our chart, does not even mention Kiev.

The way this chart is made certainly betrays Domenech's mapmaker background. His presentation is a great improvement over the merchant's manuals of the time. Instead of searching through the leaves of a book, which were inadequately indexed and poorly headed, only a glance is needed to get the answer from the chart. However, the chart is a bit more bulky to carry around than a book, and it is, perhaps, for this reason that more examples of this type of chart were not made, or have not survived for us to admire.

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N.B. Members wishing to obtain a copy of the Domenech wall chart can obtain one from the Library of Congress, Geography & Map Division, price $ 15 each, plus postage.

CITY	UNITS PER QUINTAL	No. OF EQUATIONS		WEIGHT OF 1 ROTOLI OR 1 POUND IN GRAMS	
		TOTAL	IN ERROR	ACTUAL Wt.	IMPLIED Wt.
Acre	100 Ro	5	1	2272.3	2188
Alexandria	100 Ro	8	2	449.3	424
Avignon	100 L	9	1	408.7	406
Barcelona	104 L	22	2	401.0	404
Beirut	100 Ro	5	2	-	2042
Bruges	100 L	7	-	428.8	438
Candia	100 L	2	-	-	413
Constantinople	100 L	5	2	318.9	426
Cyprus	100 Ro	4	1	2377.2	2213
Damascus	100 Ro	7	3	1785.0	1761
England	100 L	6	-	453.1	468
Genoa	150 L	11	2	318.2	312
Majorca	104 L	13	-	408.0	405
Marseille	100 L	8	1	407.9	439
Montpellier	100 L	7	-	411.1	411
Naples	100 Ro	8	2	891.0	850
Perpignan	104 L	15	1	-	394
Pisa	150 L	4	2	339.5	329
Rhodes	100 Ro	26	5	-	2355
Sardinia	104 L	3	1	406.6	412
Seville	104 L	4	1	-	541
Sicily	100 Ro	20	4	793.9	786
Tortosa	104 L	2	-	-	417
Toulouse	100 L	3	-	393.2	428
Tunis	100 Ro	8	1	503.6	495
Valencia	100 L	4	-	356.0	354
Venice	(104 L)	7	4	301.2	305

EXAMPLE: Constantinople had a quintal of 100 lb (column 2). The chart shows Constantinople with equivalent weights for 5 other markets (column 3), each with a different mathematical equation, 2 of which are calculated to be in error (column 4). Column 5 shows the weight of a surviving Constantinople pound weight, namely 318.9 grams. Column 6 shows the best, computer - calculated, estimate of the weight of that pound unit, namely 426 grams, implied by the data in Domenech's chart.

* * *

GERMAN SCALES...FRENCH SCALES...WEIGHTS IN HOLLAND...IN ITALY

Scales and weights in Switzerland...in Belgium...in Spain...in Denmark...

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SHOWCASE

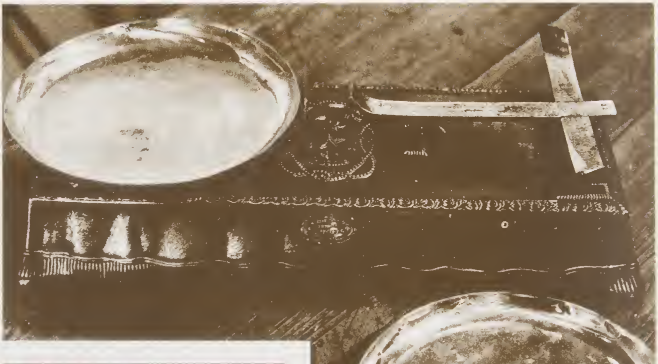


FIG 1.

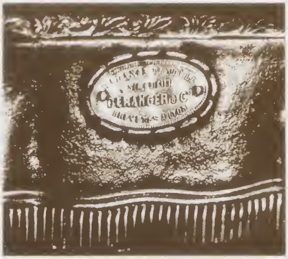
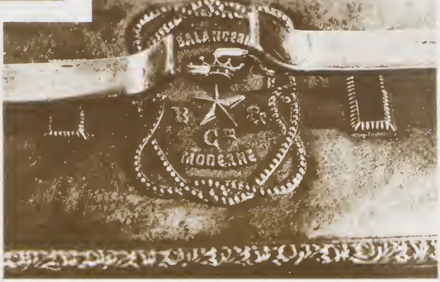


FIG 2.

FIG 3.



FIGS 1-3. A counter scale by Beranger & Cie. This rare balance has a cast metal base in the form of a cloth over a table. One pan is shown removed to reveal the supporting cradle on three legs.

AIME POMMIER PHOTOGRAPHS

Review

CONTROL OF POUNDS AND PINTS

This booklet is a fascinating account of the inspection of weights and measures in the city of Dover and its associated towns from the 13th to the 20th century. It briefly considers medieval inspection, the assize of bread and ale, the use of money scales and weights, the introduction of the first inspectors, the local units of length, volume and mass, the problems encountered by inspectors and many other aspects of metrological history. If the main theme of the book is centred on Dover and the 'Cinque ports', many aspects represent typical affairs in other British towns and have a general relevance; the gradual change in the use of the Tower, Avoirdupois and Troy pounds, the rise and fall of the Winchester bushell (and its adoption by America), the use of foreign gold coins in Britain, the progressive improvement in weighing apparatus and standards of inspection, and a great deal more.

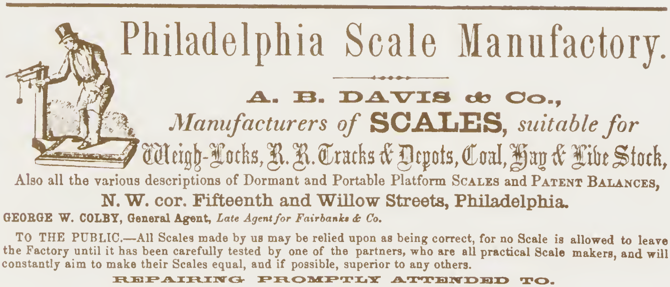
The late Ronald Stocks provided a well-written and easy to read, but detailed and technical, account of the subject, leavened with occasional stories of inspector's problems and shopkeeper's misdemeanours. The book is illustrated with eight full-page black and white photographs but three of them are marred by crude retouching.

This attractively presented booklet was published in 1975, but has only just come to the notice of the reviewer. Almost out of print, the few remaining copies are available from M.A.Crawforth (address see p.766).

'Control of Pounds and Pints' by Ronald Stocks, 1975. Paper-back; 48 pages; 8 illustrations; Price £3.00 plus postage & packing (p & p: U.K. 40p; Europe 80p; U.S.A. and other countries £2.60 air mail). Payment only in Sterling, Sterling cheque, or Sterling Bank Draft.

Old Advert

Sent in by Emil Cohn Jnr.



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REPAIRING PROMPTLY ATTENDED TO.

American Patent CCDs

A SERIES ON COUNTERFEIT COIN DETECTORS

GEORGE MALLIS

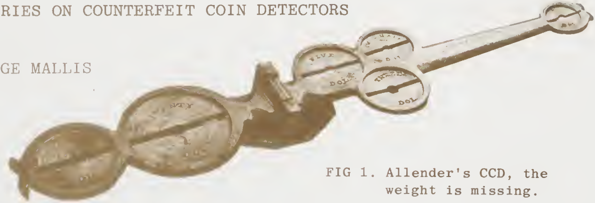


FIG 1. Allender's CCD, the weight is missing.

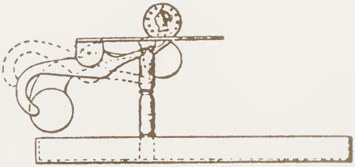
Before the advent of paper money, the credit card economy, and the "specieless" media of exchange concept of today's economic theory, all financial transactions were made in hard coin that had an intrinsic value. Such coinage consisted of major denominations in gold and silver with copper used for the minor coins. Considering the purchasing power of even minor coin in the early 19th century, it is understandable that counterfeiting played a serious role in the economics of nations. In order to combat counterfeiting, all nations took, and even today take, stern measures to protect the integrity of their monetary systems.

The average businessman in the early 15th through early 19th centuries relied upon coin scales and coin weights, plus his own observations of the coin in question, to determine if the offered coin was genuine or counterfeit. Using a small beam balance, often hand held, he would weigh the offered coin against a known coin weight to determine if the coin was of the proper weight. He would have relied upon his own "feel" and "ring" of the coin to indicate if it was counterfeit. A favourite method was to weigh the coin and then drop it upon a hard surface and listen to its 'ring' or 'timbre'. Unfortunately, while this method was acceptable during America's colonial and early republic periods, it did not suit the needs of business and commerce that began to develop in the period following 1830. Some surer and more positive method of identifying spurious coins had to be found. Thus, of necessity, was born the large family of American counterfeit coin detectors.

In discussing counterfeit coin detectors (CCDs), one must first understand how they work and what their specific functions are. First of all, such devices must have three things in common. One, they must provide for the weighing of the coin; two, they must check the thickness of the coin; and three, they must check the diameter of the coin. All three capabilities must be present to qualify as a CCD.

Weighing is accomplished either by a movable or a fixed lever acting against a counterweight from a fixed or movable fulcrum. A slot or gauge, or similar device, provides for the checking of the thickness and diameter of the coin. Often, the slot or gauge is so arranged as to prevent a spurious coin from entering the device for weighing.

Before discussing the various CCDs patented in the United States, the characteristics of counterfeit coins will be discussed. As counterfeit coins are generally made for profit, they usually are made of base metal, otherwise their intrinsic value would be the same as a genuine coin and there would be no profit for the maker. Therefore, if made of base metal, the cointerfeit coin would have to have either a greater thickness or a greater diameter, or both, if it was to weigh correctly. This is because all base metals are lighter than gold of the same volume; that is, gold has a higher specific gravity than base metal. Conversely, if the thickness and the diameter was correct, then the counterfeit coin could not weigh as much as the genuine coin. These three characteristics of counterfeit coins are the basis of all CCDs developed in both the United States and abroad. The following describes and discusses CCDs patented in the U.S. Examples of these devices are scarce, some are very rare, while others are unknown except for their patent papers.



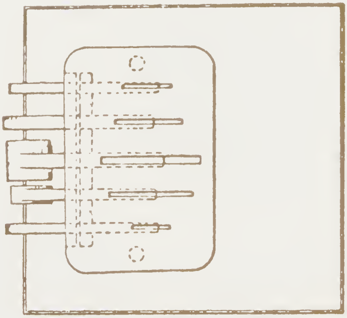


FIG 2. Patent No.9997 6th Sep.1853 Gideon B.Smith. A coin is shown where a counterfeit would remain - in the slot. A true coin would pass through.

The first patented counterfeit coin detector consists of a tray base supported on two posts which, in turn, support the gauge plate. The gauge plate has five slots for the $1.00, $2.50, $5.00, $10.00 & $20.00 gold pieces. The slots are just large enough to permit only genuine coins to pass through. Upon passing through the slots, the coin would rest on a lever correctly counterweighted to permit a genuine coin to tilt it and allow the coin to fall into the tray base. While the basic patent was for gold coins, the inventor's claim indicates that suitable modifications would permit testing of silver coins. ▷

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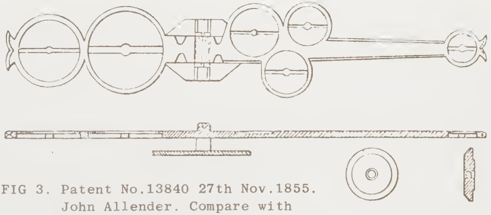


FIG 3. Patent No.13840 27th Nov.1855.
John Allender. Compare with
photograph in Fig 1.

Fig 3 is a very simply designed CCD consisting of a single lever supported on a fulcrum set on a short base. Countersunk receptacles were designed for gold pieces of $1.00, $2.50, $3.00, $5.00, $10.00 and $20.00. The diameter of the receptacle would accept only genuine coins. The slot in each receptacle would allow only a genuine coin to pass through. A coin was weighed by being placed in its appropriate receptacle and, if genuine, would tip the balance against the counterweighted arm. To weigh the ten and twenty dollar pieces, a supplementary weight was placed in the $1.00 receptacle. This detector was made of brass and was available in two models, one with a $3.00 coin receptacle, the other without.

Showcase

FIG 4. Pot weights by Day & Millward, 4 lb and 2 lb. Black letters.
BOB HOLDAWAY COLLECTION

FIG 5. Proportional weight marked 'Weight Maker St.George' and '1 lb equal 14 lb' Iron.
MICHAEL ROBINSON COLLECTION

FIG 6. A group of German weights showing various verification marks - to decipher this type of mark, see The Handbook of Old Weighing Instruments (ISASC).
DIRK SCHMITZ COLLECTION

FIG 7. Ring weight with a copper plug on the handle stamped for Devon. Iron, 4 lb.
BOB HOLDAWAY COLLECTION

FIG 8. Lead weight of Charles I or II, with the 'dagger' of London and the Angel of Plumbers Co.
MICHAEL CRAWFORTH COLLECTION

FIG 9. Quadrilobe iron ring weight, 7 lb, unusual English design.
BILL DONIGER COLLECTION

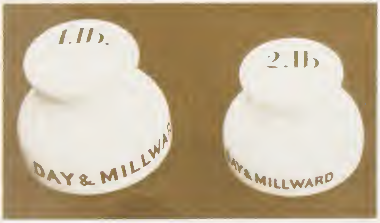
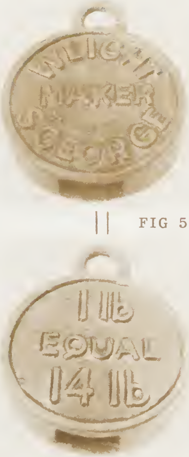


FIG 4.



|| FIG 5.

SHOWCASE

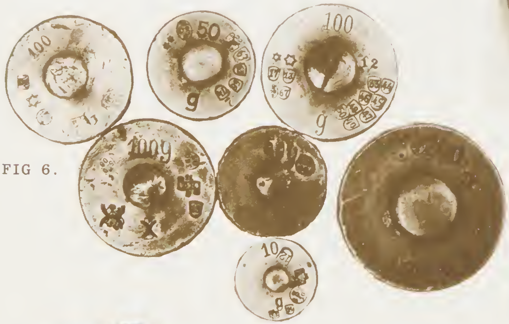


FIG 6.

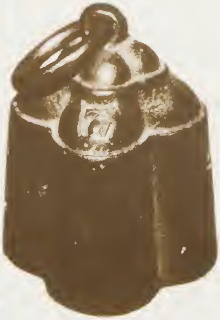


FIG 9.

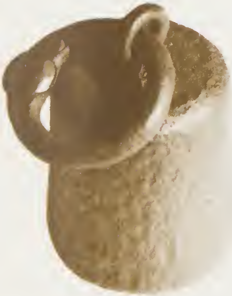


FIG 7.

FIG 8.

Precision Balance 10

HANS JENEMANN

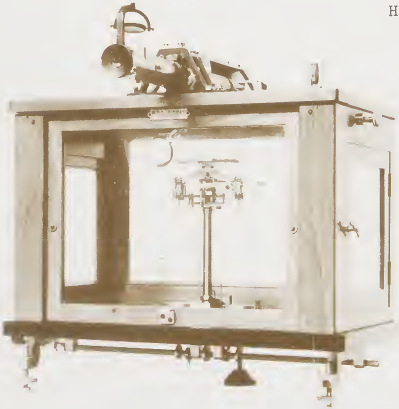


FIG 1

This "Ultra Micro Balance" for chemical and physical use, was made by Wilhelm H.F.Kuhlmann, in Hamburg, c1930, Fig 1. As a special feature, the balance was equipped with an autocollimation telescope, to read more accurately in the inclination range, the last two decades of the weight readings.

The beam of the balance has a length of only 72mm (2.8") and it is made in a compact form. It is provided with, on its upper part, a graduated scale for a rider weight, divided into 100 parts, beginning above the left knife. As with Precision Balance No.7, such asymmetric divisions always need the rider weight in action, even in the null position.

On the left side of the case, there is a crank which moves the spindle for parallel arrestment. With a pointer and a graduated arc on the front, and a plumb-line behind the column for levelling the balance, we find the usual components of such instruments. The dimensions of the case are 380 x 220 x 300mm high (15"x 8.6"x 11.8"), and there are two side doors, in addition to the sliding front window.

The maximum capacity of this balance is 200 grams. Using a normal set of analytical weights for micro-balances, the weights were used down to 10mg. The weight range from 10mg to 0.1mg was served by the rider equipment, using a 5mg rider weight. As the rider scale from the left to the right knife covers all the length of the beam, one part of the 100 divisions corresponds to 0.1mg. The range of 0.1mg down to 0.001mg was determined by the optical arrangement of the autocollimation telescope, observing in the inclination range (i.e. the equivalent of reading the deflection of the pointer on a simpler balance). We can compare reading the last two decades of the weight using a micro-balance working in the range 20g to 0.001mg, with the macro analytical balance, which works in the range of 200g to 0.1mg: In each case, the set of weights is used down to 10mg, but with the macro balance the last two decades (10 to 0.1mg) are read either by the rider weight OR by the inclination of the pointer. Whereas on micro -balances of the Kuhlmann type, these two readings are used one after the other to take the range down from 10mg to 0.001mg.

The function of the autocollimation telescope is based on the principle of the, so-called, 'mirror reading' attributed to J.C.Poggendorf (1796-1877). He first used mirror reflection and reading when he was measuring magnetic deflection, in 1826. He fixed a little mirror to the core of a magnet suspended on a fine cord. A fine beam of light was directed onto the mirror so that when the mirror was turned by magnetic deflection, the angle of the reflected light beam was twice that of the mirror deflection. Thus the light beam acted as a long, mass-less, pointer which 'magnified' the reading.

The first man to use Poggendorff's principle on balances was C.A.Steinheil (1801-1870), when he carried out metrological weighing in 1837, comparing the Bavarian kilogram with the kilogram of the Archives in Paris. His balance is stored in the Deutsches Museum in Munich and is known as the famous 'kugelwaage of Steinheil'. The beam was not supported on a knife-edge, but on two little balls. Figure 2 shows Steinheil's arrangement of the mirror system used by Poggendorff, in this case, in a modern version combined with optical projection of an electric light beam. Here, the light beam is reflected two times at the beam of the balance, which results in an angle of deflection four times greater than the original. In this way, a very good sensitivity can be achieved in the inclination range.

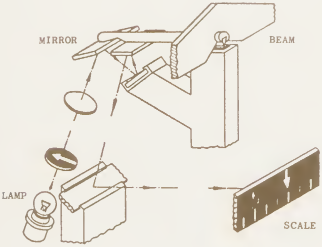


FIG 2. Poggendorff's mirror system on a modern balance made by A.Sauter, Ebingen, 1950.

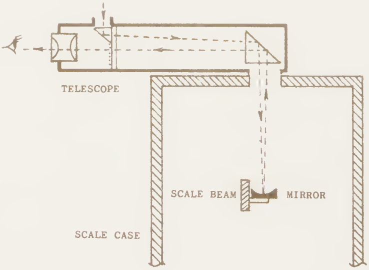


FIG 3. The autocollimation principle using lens, prisms and mirror.

The use of the autocollimation* telescope on Kuhlmann's balance, Fig 1, is another variation of mirror reflection. In this case, the light beam is directed to the mirror attached to the beam, by a system of reflection prisms which give total reflection. Thus, it is possible to read the inclination of the beam from the optical reflection of a fine line against a very finely divided micro-scale fitted in the eyepiece of the telescope. This principle is shown in Fig 3. Paul Bunge, of Hamburg, was the first man to use autocollimation on his balances in 1880.

Wilhelm H.F.Kuhlmann (1867-1945) had been an apprentice of Paul Bunge, whose assay balances set the pattern of the later micro-balances, Fig 4. Kuhlmann opened his own workshop, also in Hamburg, in 1893, and his work was based on that of Bunge.

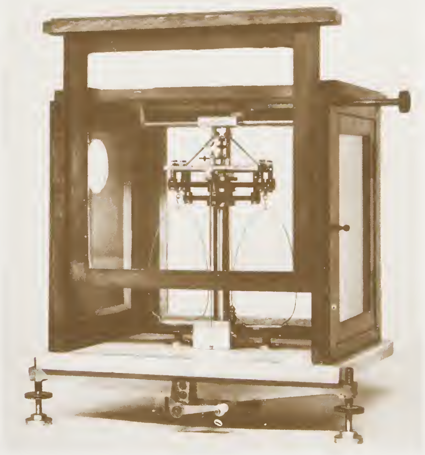
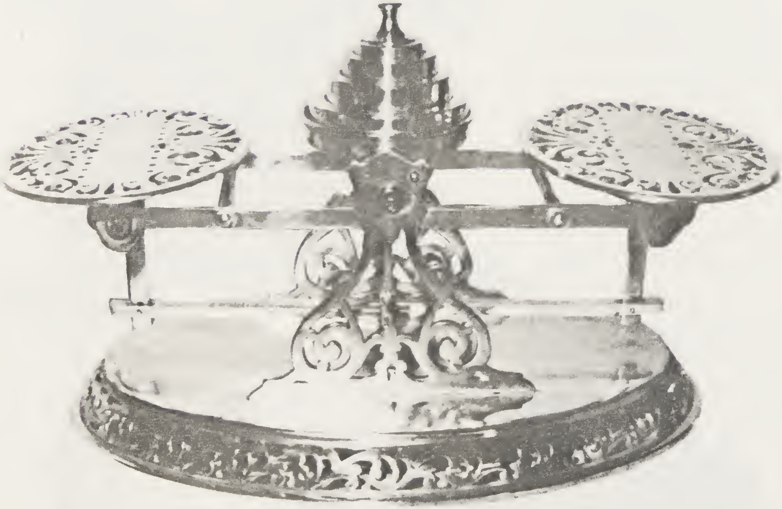


FIG 4. The Bunge assayer's balance, made in 1870, now in the Physikalische-Technische Bundesanstalt, Braunschweig (Brunswick). This assay balance formed the pattern for later micro-balances. Beam length 70mm. Height 200mm.

** COLLIMATION is a means of making light beams parallel so that objects at different distances can be seen clearly, simultaneously, without refocussing the eyes. Here, the image of the index on the beam can be seen at the same time as the scale set into the eyepiece of the telescope. (Editor).*

Balancing It Out

by Betty Rivera



Silver postal scale marked "sterling" and probably American found in Thomaston, Maine. Courtesy of Barbra Fogler and Wynona Crossgrove.

According to the Koran – sacred book of the Mohammedans – on Judgement Day, the archangel Gabriel will weigh each person's deeds on his scales. Good deeds will be weighed on his "Light" scale; evil ones on his scale called "Darkness." If a person's good deeds outweigh his evil ones, he will be able to cross a perilously narrow bridge to safety.

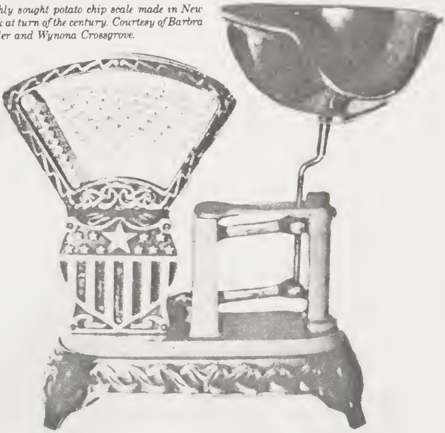
Tangible items – gold, iron, tobacco, eggs, hair, silk, letters – have been weighed on various devices since the fifth millennium, when Egyptians invented the equal-arm balance: a beam suspended at its middle point and with a pan attached by a cord at each end of the beam.

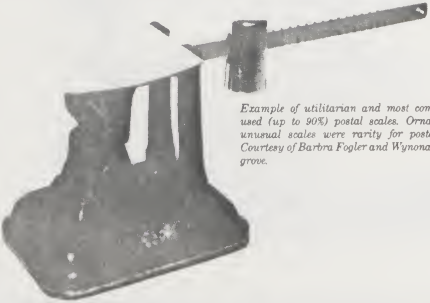
Refined and changed in principle throughout the centuries, scales have been made in many materials, including silver, gold, wood, brass, and even papier-mache to serve functionally and, at times, decoratively.

Intrigued by the broad diversity of scales, Wynona Crossgrove and Barbra Fogler, of Storrs, Connecticut – two of the nation's leading antique scales dealers – started collecting and selling old scales about a decade ago. They exhibit many diverse and unusual ones at antique shows under the name "Nobody's Bizness But Our Own Ltd." Both dealers are quietly hospitable and knowledgeable. Talking with them about scales is like opening a history book to a fascinating chapter.

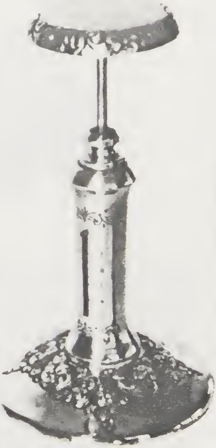
When I recently spoke with them at an antique show, they showed me a variety of scales, including one for the weighing

Highly sought potato chip scale made in New York at turn of the century. Courtesy of Barbra Fogler and Wynona Crossgrove.





Example of utilitarian and most commonly used (up to 90%) postal scales. Ornate and unusual scales were rarity for postal use. Courtesy of Barbra Fogler and Wynona Crossgrove.



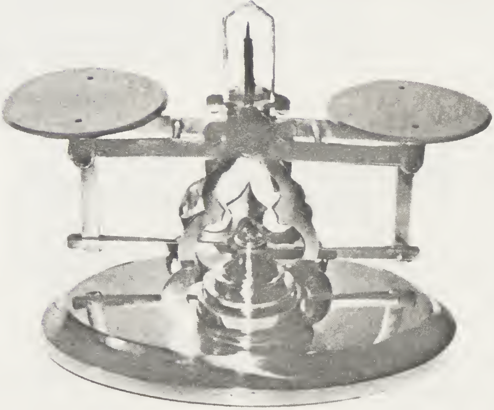
Sterling candlestick-type postal scale by Gorham (circa 1870). Courtesy of Barbra Fogler and Wynona Crossgrove.

of buffaloes. Barbra demonstrated the use of a dynamometer – a scale used by physicians to measure physical strength. She also mentioned that her own interest in scales was aroused when her mother-in-law showed her a scale bought by an ancestor who ingeniously used it to weigh a baby by suspending the baby from it in a tightly-tied napkin.

Since that time, Barbra and Wynona have found scores of scales designed, and sometimes patented, for specific purposes – everything from testing the tensile strength of yarn and rope to measuring the butterfat content in cream. Such scales also include choice eighteenth-century ones for the weighing of coins.

The weighing of gold and silver coins originated in early Roman years. During the seventeenth and eighteenth centuries, when gold coins were commonly exchanged as currency, bankers and merchants customarily owned coin scales which ranged from simple to elaborate. In fact, these businessmen frequently carried tiny pocket scales to check the true weight of a coin. These scales often consisted of a simple brass device with a weight at one end and a circular pan designed to hold the coins at the other.

Elegant brass postal scale issued by Tiffany when this firm was located in Union Square in New York City, made 1850-1858. Courtesy of Barbra Fogler and Wynona Crossgrove.



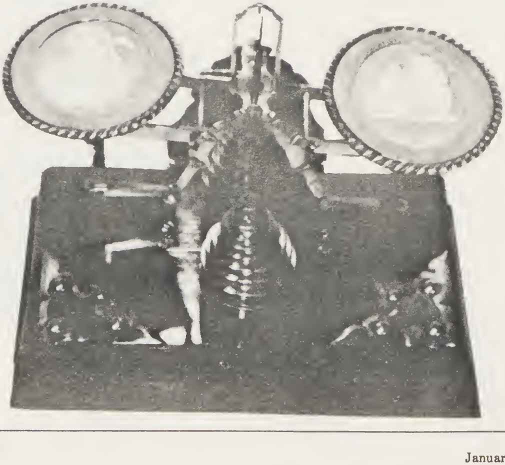
Or they carred more intricate ones which folded compactly into narrow wooden pocket-sized cases. Such scales were necessary equipment indeed for bankers and merchants, as coins did not have grained edges in those years. Dishonest individuals habitually chipped slivers of gold from edges of the coins.

During the late eighteenth and early nineteenth centuries, when American sailing vessels adventurously plied the seas, "sea captains," Barbra Fogler said, "found it prudent to have scales conveniently at hand when they traded at Canton and other foreign ports."

Grain scale, also used by marine merchants, incorporated such as a pint measure so that, Barbra said, "a bushelful of grain could be ascertained by merely weighing a pintful." It can be conjectured that the luxurious Chinese silks long-ago coveted by American women were also weighed on silk scales by sea merchants before the silks were brought to waiting ships for future elegant gowns.

In centuries past, scales were usually openly displayed in grocery stores. A red counter scale, accompaned by weights and a boat-shaped tray of brass for the weighing of sugar, crackers, beans, meat, and sundry other groceries, was in daily use there. Hanging over the counter, one

Ornate brass English postal scale with burled rosewood base and Wedgwood plates (circa 1860). Courtesy of Barbra Fogler and Wynona Crossgrove.



German, porcelain quadrant scale with a winged woman with dolphin and seashell decoration. Courtesy of Barbra Fogler and Wynona Crossgrove.

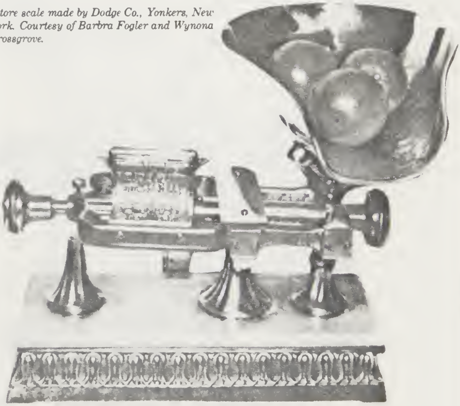
ordinarily saw an older type scale with a center fulcrum and two arms. One arm held a large tin scoop for the containment of the article to be weighed as well as a plate to hold the weights.

The steelyard, another type of weighing device – varying in size from small to large – hung from a store's ceiling. It had a fulcrum and one arm that carried a pear-shaped weight which moved along graded notches. A pan made of tin or copper – sometimes a foot in diameter – was suspended by long arms beneath the fulcrum. Items weighing "thousands of pounds," Barbra said, could be weighed on large steelyards.

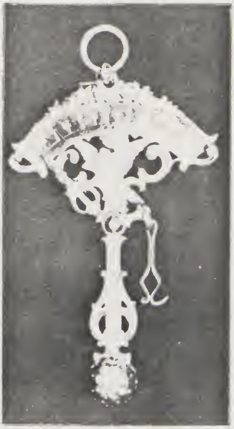
It is interesting to realize, too, that goldsmiths and silversmiths of centuries past were versatile craftsmen who not only made jewelry and clocks but also worked with copper and brass and made fine mathematical instruments as well as scales. An advertisement in the *Boston Newsletter* of October 22, 1767, stated the jeweler Daniel Boyer had for sale rings, beads, a "Pair of Cluster Earings" and "Money Scales and Weights."

Among scales, however, none are more diverse than postal scales. Introduced in 1840, when mail began to be charged according to weight rather than by the number of pages contained in the letter and the distance it would travel, these

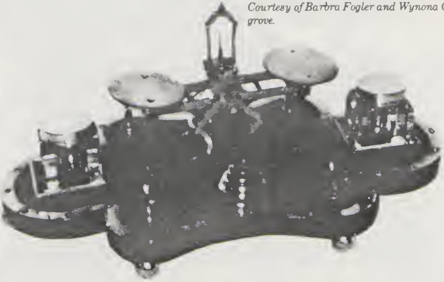
Store scale made by Dodge Co., Yonkers, New York. Courtesy of Barbra Fogler and Wynona Crossgrove.

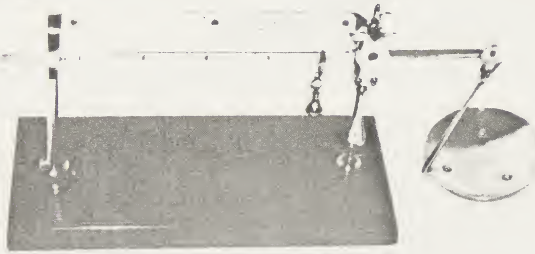


Hand-held pendulum balance postal scale made by Gorham for Shreve Crump & Lowe (circa 1887). Courtesy of Barbra Fogler and Wynona Crossgrove.

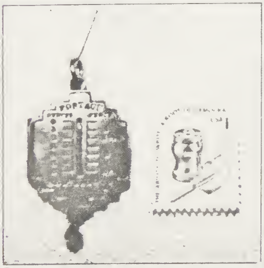


An English, brass postal/desk set specifically designed for a partner's desk. Besides double inkwells, has a full set of postal weights, and pen holders (on two sides of scale), circa 1865. Courtesy of Barbra Fogler and Wynona Crossgrove.





An estimating scale by Avery. A single small item placed in pan, balancing with moving poise, indicates the weight of a gross or pound of that particular item. Courtesy of Barbra Fogler and Wynona Crossgrove.



Gentleman's watch fob or lady's postal scale to be worn on a chain around the neck. Hinged compartment behind holds postal stamps (circa 1850). Courtesy of Barbra Fogler and Wynona Crossgrove.

Dairy scale. Chart indicating up to 20 cows is placed under face of scale. As each cow is milked, the brass knobs across top register number of pounds of milk each cow has given. Courtesy of Barbra Fogler and Wynona Crossgrove.

scales have been designed in countless forms and of many materials. They have a type of pincer mechanism devised in the mid-1800s: a device which led to the modern dial scale and computing counter scales in grocery stores. Often, postal scales may be dated by postal rates engraved upon them.

Appealingly, some of these postal, or letter scales, are oppulently handsome and fanciful with inclusions of Wedgwood, boule, and pietra dura. Others are elegantly made of sterling silver or of brass. Barbra and Wynona have a brass scale with reticulated brass plates which belonged to a long-ago Duke of Wellington.

Many firms in England, Germany, the United States, and other countries made scales. The variety of scales used at the turn of the century is impressive. At the Philadelphia Exposition in 1876, 300 different weighing devices were exhibited by one company alone. The Fairbanks Brothers patented the first American postal scale in 1859, but Howard & Davis, of Boston, Massachusetts, essentially a clock-making firm, garnered the first contract for postal scales with the United States Postal Department in the mid-1800s.

Barbra remarked to me that people who offer to sell them scales often have amusing "misconceptions" regarding them. She said one person was certain that his scale with plates marked "pistole" (an old European gold coin) was for the weighing of gunpowder. Another person desiring to sell her rare old "lettuce" scale (actually a letter scale) was convinced it was contrived to weigh one leaf of lettuce to determine the weight of an entire head!

Dealers specializing in the selling of antique scales can offer both the novice and sophisticated collector valuable advice. Wynona advised, "The collecting of scales should be preceded by the reading of books about them and by visiting antique shows and museums where examples of them can be viewed."

The International Society of Antiques Scale Collectors (an international society with about 300 members) was founded "so that people who collect scales could form friendships, correspond, and meet with each other, and, in general, enhance the pleasure of collecting." Membership in this society can be obtained by writing Bob Stein, 20 North Wacker Drive, Chicago, Illinois 60606.

Fountain pen-shaped scales have been created to weigh letters; other scales have been designed to weigh racing pigeons. In England, a balance measuring approximately 6 inches was made specifically to weigh "mints for the Queen" – one-half pound at a time. The Queen with the sweet tooth was apparently Victoria, as this type scale appeared about 1860.

Whether you decide to collect an egg scale to enhance a country kitchen, a delicately designed sterling silver postal scale for a lady's desk, a prestigious brass one for a man's desk, or an assemblage of coin scales, you will find yourself embarked upon a venture that promises pleasant broadening of your horizons. ☐

over

QUESTION BOX . . .

JONES'S SCALES

Can you help me identify a counter scale, the platform type possibly used in a hardware store? It is 21 inches long, 12 inches wide and 24 inches tall. The weighing mechanism is white brass, the rest cast iron and painted red with gold trim. The only identification is "Jones" painted in gold on each side and "Jones of Binghamton" stamped on the brass beam. How old might it be, where and who made it, and what might its value be? **—R.S., Bryan, Ohio**

Comment: T.S. Carley, Vice President of International Society of Antique Scale Collectors, 407 Kingston Terrace, Deerfield IL 60015 reports that Jones of Binghamton was established in 1865 and incorporated in 1888. Jones served in the Civil War and rose to become a general During his career he was Lt Governor of New York at one time.

Pages from an old Jones catalogue were enclosed, issued ca 1885. "Jones must have been a 'character' as I think you will agree after reading this literature," Carley wrote. The longevity of the company is not known

Carley adds, "It (scale) sounds like a low slung type of platform scale One of the most distinctive things about Jones' scales was their cloverleaf design. Instead of the 'bird foot' pedestal, the three 'toes' were in the shape of a clover Also each 'C' weight was in the shape of a clover "

(Annual membership in ISASC is $35, which includes annual directory of members and four issues of "Equilibrium," a quarterly journal.)

Excerpts from the Jones catalog follow:

"Its (Jones scales) general construction is on what is known as the Fairbanks principle, invented and patented by Fairbanks, who enjoyed the monopoly of this valuable patent as long as money could avail to get it extended, and by its exclusive control massed millions of dollars."

Of the firm's "One Horse Scale," intended for warehouse or mill use, the Jones catalog suggested: "Where there is not a small scale in the house, the Old Lady will find it convenient for dairy and pantry. It is light and portable, and very handy to lend to the neighbors."

We didn't find a current Jones price listing, but similar scales are in the $80 to $145 range.

EVEN BALANCE

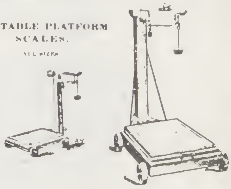
GROCERS' SCALES.

FAMILY SCALES.

COUNTER SCALES.

PORTABLE PLATFORM SCALES.

ALL SIZES



RAILROAD TRACK SCALES.

ISASC

EQUILIBRIUM®

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

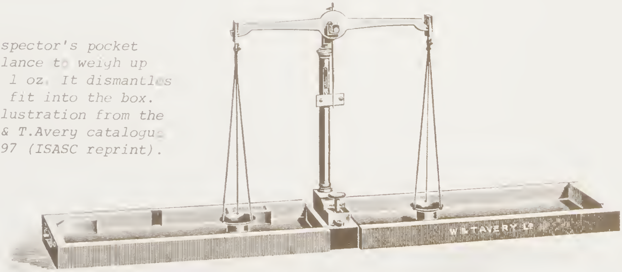
1985-ISSUE NO. 3

PAGES 793-820

Cover Picture

This group of scales shows the range in size used by apothecaries, from a small hand-held balance to a large stand scale and a robust roberval counter-scale. At the rear: an anonymous stand scale similar to those shown in the 1880 catalogue of W.& T.Avery as suitable for apothecaries, chemists and druggists. Left: a small stand scale which dismantles to fit inside the drawer. The lever is stamped "DeGrave, Short, Fanner & Co, London". Right: a roberval counter-scale which was illustrated as a "New Invented Machine for Druggists", in the 1850 catalogue of W.& T.Avery, to weigh from 1 ounce to 2 pounds. The weights were kept in the drawer. Front: Hand scales with glass pans and a swan-neck beam. The bright yellow label is signed "W.& T. Avery" with "Limited" added on the right, subsequent to the original design of the label. This suggests a date in the 1890s, shortly after Avery became a limited company.

Inspector's pocket balance to weigh up to 1 oz. It dismantles to fit into the box. Illustration from the W.& T.Avery catalogue 1897 (ISASC reprint).



INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Founded September, 1976

20 North Wacker Drive • Chicago, IL 60606 • U.S.A.

President	Bob Stein
Vice Presidents	Michael A. Crawforth, Robert W. Miller, Tod Carley, Gerard Houben
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Alternative Shapes for Analytical Weights

BEN HILGERSOM

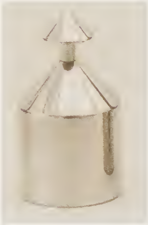


FIG 1.

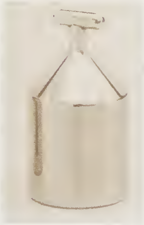


FIG 2.

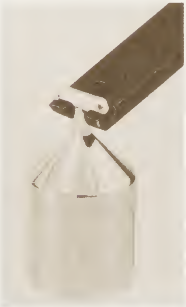


FIG 3.

The surface of weights in use in a laboratory environment is often badly corroded. This is particularly the case with horizontal surfaces, Fig 4. The construction of typical cylindrical weights, which have approximately a 90° angle between knob and top surface, hampers simple and adequate cleaning to remove dust and chemicals. Typical corrosion is shown on the left weight in Fig 4.

Corrosion of metals causes permanent damage. The surface is no longer smooth, and the surface accretions may raise doubts as to the validity of the weights. In short, the weight no longer fulfils its purpose of precise measurement.

In view of these objections to existing weights, I have attempted a number of improvements. The 100 gram weight in Fig 1., I designed to have several advantages, which are based on the following considerations:-

a) The most vulnerable part of conventional designs is the top surface of the cylinder. By sloping this surface, dust and other particles slide off easily.
b) The top of the knob, too, collects dirt, so it has to be replaced by an inclined surface.
c) The junction of the knob and body of the weight should be at an obtuse angle to facilitate easier cleaning.

The result of my re-design is a weight which I have called a 'rooftop' weight, Fig 1. This works well in vastly reducing the dirt which normally accumulates on weights, and makes the weights easy to clean.

Another important point is the way weights are picked up - by hand, with tweezers, or with a weight-lifting fork. For precision use, using small weights, tweezers or a fork is essential. In this respect, the 'rooftop' weight was no improvement on conventional weights, which easily slip out of tweezers or slide off a fork, with consequent damage to the weight or to anything it might fall on.

To solve this problem, I replaced the rooftop knob by a T-handle, Fig 2. With this, there is very little risk of the weight falling off the fork because the bar at the top of the handle rests in a groove in the fork Fig 3. This fork is made of plastic material (PVC) which is easy to machine and will not damage the weights. However, transversely grooved tweezers would be equally satisfactory.

The T-handle maintains the functional qualities of shedding dirt and corrosive chemicals, as the top of the handle is rounded.

T-handles have been used before, to my knowledge only in Britain, for calibration weights. Well known is a series of weights increasing up to 56 lb, cylindrical in shape and probably dating from around 1900. Another series has T-handles on spherical weights, dating from 1930-40. Only the spherical weights meet the requirements discussed here, but both series revert to the use of knobs for the smaller sizes.

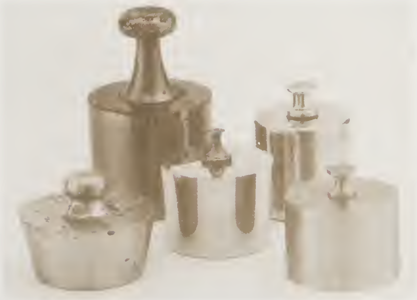


FIG 4.

The application of my design does not have to be restricted to weights for fine measurement. Surfaces seriously damaged by water are found mainly on cast-iron weights of 1, 2 and 5 Kg. For these weights my construction would be particularly useful.

Weights of my design are currently in use in the Physiological Laboratory of the University of Amsterdam, and others in the Jan Swammerdam Institute.

One may question the usefulness in the present day and age, of occupying oneself with the construction of weights. The weight has, after all, been replaced to a large extent by automatic mechanical and electronic systems. Such systems, however, must be checked from time to time, and for such purposes one will always need a number of standard weights. Accurate weights therefore, are here to stay.

EDITOR'S COMMENT:
I was very honoured to be presented with a pair of Ben's weights, several months ago, and I can vouch for their great practicality and elegance. It is almost impossible to drop the T-handle weight, and the design allows much latitude in handling the fork.

English Apothecaries Scales & Weights

PART 1 : SCALES

MICHAEL CRAWFORTH

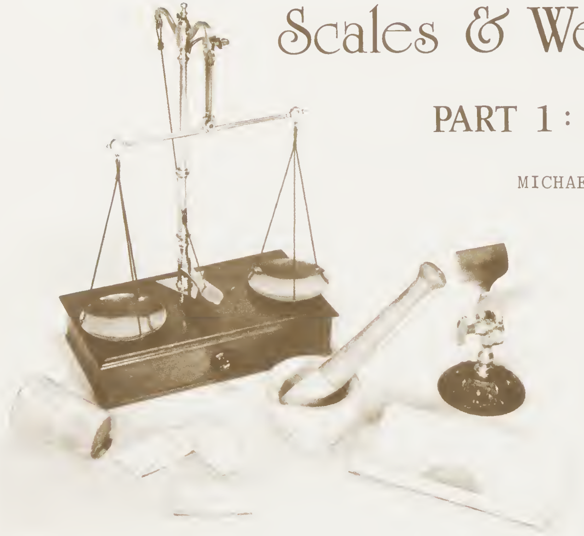


FIG 1. (p.803)

INTRODUCTION

At one time, English apothecaries were members of the Guild of Grocers, but in 1617, they split away from their parent body to form the Society of Apothecaries, a guild in its own right (4).

Strictly speaking, an apothecary simply dispensed medicines prescribed by a physician, but in practice an apothecary's shop was not just a retail outlet for medicines. It was also a place where basic medical advice was available to the many people who could not afford the fees of physicians. Those apothecaries with a natural ability to diagnose ailments tended to become medical practitioners, while the others specialized in accurate dispensing. By 1775, these two groups had become distinct branches of the profession and, because 'trading' apothecaries were considered to have lower status, they were no longer allowed to become liverymen of their society (4).

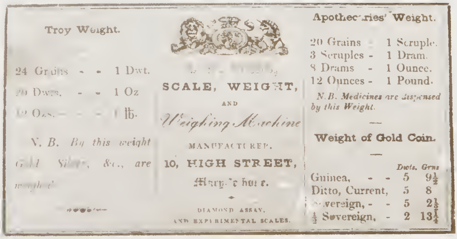
Apothecaries obtained their materials from the chemist, who supplied mineral chemicals, and from the druggist, who sold drugs of animal and vegetable origin. As time went on, these three trades merged, and by the end of the 18th century, the combined apothecary, chemist and druggist was well established (4). This new profession was given official recognition with rights to buy, compound, dispense and sell drugs and medicines, wholesale and retail, by Act of Parliament, in 1815 (4).

Thus, the medical profession was composed of apothecaries, druggists, chemists and physicians, and by men who combined two or more of these functions. Each branch had its own slightly different requirements for balances and weights.

SCALES

Apothecaries and physicians used small hand-scales to make-up individual prescriptions of pills and powders for a customer or patient. Hand-scales were preferred for this task even though scales suspended from a pillar, or standard, were available. It was the same in America where Procter reported, in 1849, *"The standard balance* (pillar scale) *is not so convenient for dispensing as that which is supported in the hand..."* (3). However, by the end of the 19th century, English apothecaries had begun to use small scales suspended from a pillar on a drawer base.

Larger pillar scales were used by druggists and chemists for weighing wholesale quantities of drugs and chemicals, and in the 19th century, Roberval and Beranger scales began to be used. Of course, those people who combined all three functions of apothecary, druggist and chemist used both small and large scales. (See Cover Picture).



Troy Weight.

24 Grains - - 1 Dwt.
20 Dwts. - - 1 Oz
12 Ozs. - - 1 lb.

N. B. By this weight Gold Silver, &c., are weighed.

[illegible]

SCALE, WEIGHT,
AND
Weighing Machine
MANUFACTURER,
10, HIGH STREET,
Mary-le-bone.

DIAMOND ASSAY,
AND EXPERIMENTAL SCALES.

Apothecaries' Weight.

20 Grains - 1 Scruple.
3 Scruples - 1 Dram.
8 Drams - 1 Ounce.
12 Ounces - 1 Pound.

N. B. Medicines are dispensed by this Weight.

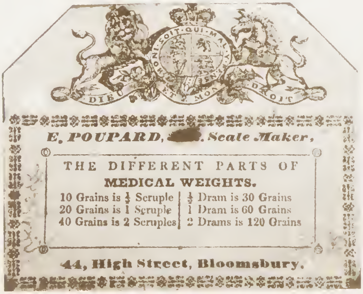
Weight of Gold Coin.

	Dwts.	*Grns*
Guinea, - -	5	9½
Ditto, Current,	5	8
Sovereign, - -	5	2½
½ Sovereign, -	2	13¼

FIG 2.

The professional users of small hand-scales were relatively few in number, and do not account for the great number of such scales which have been seen in recent years in antique shops, fairs and auction houses. The reason for this lies in the numerous alternative applications for small hand-scales and their use by people other than the professionals. It is probable that the majority of cheaply-made hand-scales with apothecary weights were used in the home for domestic medication. As Dr.Young has pointed out (11) *"Two hundred years ago, prescriptions or 'receipts' were as likely to be provided by the handwritten notebooks of the family, as by a physician or an apothecary, and, considering the slowness of transport at that time, most households would need to have access to, and some knowledge of, the use of the medicines then in vogue in order to start treatment whilst waiting for the doctor to arrive"*. On the last of these points, I think ordinary families very rarely called for professional help. The majority of households could not afford a doctor and turned to Granny's herbal remedies, sometimes spooned out and sometimes weighed out carefully.

In wealthy households, vicarages and on board ships, the scales were usually in attractive and comprehensive medicine chests (11), but in a great many ordinary homes, scales were in the common oak or mahogany boxes, Figs 9,14,25. Many examples have survived where handwritten tables of apothecary weights have been affixed inside the lid, by the owner, and a particularly nice example included the following instructions for children's medicine: *"In proportioning the dose of any medicine to the age of a Child, as a general rule a patient of 14 will require about 2 thirds of the quantity proper for an adult; if 7 years old one half; if three years one fourth; and if 12 months one eighth..."*


HONI SOIT QUI MAL Y PENSE
DIEU ET MON DROIT

E. POUPARD, [illegible]. Scale Maker,

THE DIFFERENT PARTS OF

MEDICAL WEIGHTS.

10 Grains is ½ Scruple
20 Grains is 1 Scruple
40 Grains is 2 Scruples
½ Dram is 30 Grains
1 Dram is 60 Grains
2 Drams is 120 Grains

44, High Street, Bloomsbury.

FIG 3.

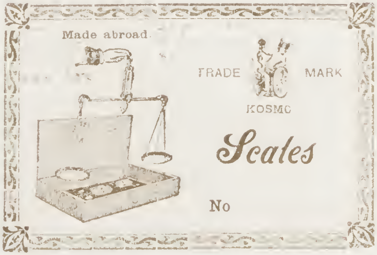


FIG 4.

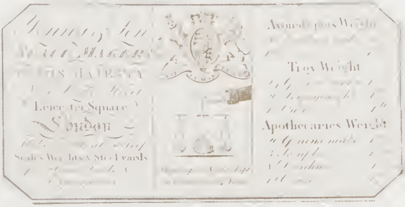
With the invention of photography, small hand-scales became a necessary part of photographic equipment, to weigh-out the chemicals used for developing plates and prints and fixing the images. 'Apothecary' scales and weights were ideal for this purpose, and they were advertised in photographic catalogues, c.1910. Thus, many of the surviving scales and weights were probably sold for use by photographers, and not for medicine.

If 'apothecary' scales could be used for other purposes, other small scales like coin scales, could just as easily be used to weigh medicines. It seems, therefore, that the scale-maker or retailer kept boxes of small scales on his shelf and that he added the relevant weights at the time of purchase, according to his customer's needs. Similarly, a scale user could readily adapt his scales for any other purpose, simply by adding the appropriate weights and discarding the original ones if they were no longer required. Many coin scales which have survived to the present day, have been adapted in this way. Adaptability of small hand-scales was recognised on the labels of some scalemakers, like John Young & Son, whose label, c.1820, included lists of Avoir, Troy and Apothecaries weights, thus covering medicines, chemicals and precious metals, Fig 5. In the 1840s R.W.Webb's label listed Troy and Apothecaries weight and the weights of coins, Fig 2.

The wide range of purposes for which small scales were suited raises the question, can the original purpose be deduced, now, so many years after the scales were made? In many cases, the answer has to be no, but there are some guidelines which indicate strong probabilities. In their survey of the large Wellcome collection of scales and weights, Crellin & Scott (2), concluded that pan diameter was a good indication of their original purpose:-

Scales in pocket-sized boxes.	**with pans 30 - 50mm dia. (1.2 - 2") for coins.** **with pans 40 - 80mm dia. (1.6 - 3.2") medicines.**

The overlapping sizes between 40 & 50mm dia. were equally suitable for either purpose. Larger sets in boxes 70 - 100 x 150 - 200mm (2.75 - 3.9 x 5.9 - 7.9") were for shop counter or table top use, rather than being carried in the pocket, and their purpose is almost impossible to distinguish. Many boxes of hand-scales, of all sizes, had weights for both coins and medicines, and a dual purpose must have been common - the physician or apothecary, having dispensed the medicine, needed to test the gold coin with which he was paid!



Leicester Square

London

Troy Weight

Apothecaries Weight

FIG 5. Label from hand-scales shown in Fig 10. John Young's son joined the firm in 1810. Royal arms for period 1801-1816.

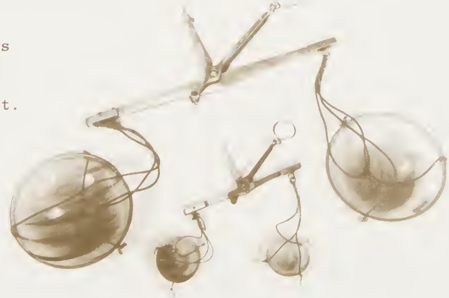
While most scale boxes with weights in open pens have an indeterminate purpose, others with weights fitted in individual sockets can be definitely attributed to one purpose or another. The box by Young & Son, c1820, Fig 10, has well-fitted apothecary knobbed weights for 2,1,½, drams and 2,1,½, scruples, I.W.Herbertz' box of c.1780, was provided with weights for both medicines and coins, 2,1,½, ounces troy, 2,1,½, drams, 2,1,½, scruples, 5,3,2,1, pennyweights, and 1,½, guinea - a splendid set. It may be conjectured that made-up boxes with two weight pens were made with a dual-purpose in mind, to separate apothecary weights from money weights, if required.

During the 19th century, it became increasingly common to provide tables of apothecary weights on labels of scale boxes, sometimes bearing the maker's name and address, Figs 3 & 7, but often anonymous, Fig 26. Here, there can be no doubt about the intended purpose, although Crellin & Scott (2), deduced that labels were applied indiscriminately by makers. However, they may have received this impression from the many coin scales which were later adapted for weighing medicines or photographic chemicals.

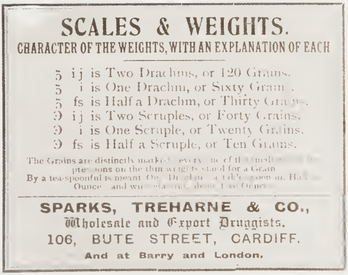
A very good indication of purpose is the material used for making the pans. Chemicals are corrosive and many hand-scales surviving today, with badly oxidised patches on the brass pans, are ample evidence of this problem. To reduce or eliminate corrosion, scalemakers offered pans made from alternative materials. Glass was very common, while silver, horn, nickel-plating and mother-of-pearl were rather rare. Of these materials, silver was probably the least satisfactory, and certainly the most expensive. Hall-marks on silver pans usually indicate the silversmith who made the pans, rather than the scalemaker who fitted them to his scales. As all these alternative materials cost more to buy - Avery's hand scales with brass pans were 13s 6d, with glass pans 14s, and nickel plated 16s, in 1906 - the majority of hand scales had brass pans, and the owner had to clean them scrupulously or tolerate their deterioration. If a scale has pans made from a corrosion-resistant material, it can be assumed that the intended purpose was to weigh medicines or chemicals, rather than coins.

Apothecaries also used slightly larger hand-held scales with one deep copper pan about 60 - 80mm in diameter (2.3"- 3.2"), and a matching copper scoop. They were used for weighing larger quantities of material, and in catalogues they were called 'poison scales'. However, the same scales were also advertised in catalogues for tea-tasting and snuff selling, as well as for poisons. Again, it is impossible to tell whether the purpose was for tea, snuff or medicines. Tea-taster's scales can be distinguished by the small captive weight attached to one cord ring inside the pan - if it has not been mistakenly removed by a person unaware of its purpose! A particularly small example of a 'poison' scale is shown in Fig 17. Usually, the pans are much deeper Fig 19.

FIG 6. Two brass beams with horn pans imported from Germany for the British market. Beam lengths 7" & 3".



Pillar scales, too, had many applications. The better quality ones, with box-end beams, Fig 21, or continuous knife edges, Fig 23, and mahogany drawer bases, were advertised in trade catalogues for use by apothecaries, druggists, chemists, laboratories, jewellers and bankers. Those with brass pans were used for all these purposes, while those with glass pans were for medicines or chemicals, and were very common. During the 19th century the use of a metal hanger and a lift-off pan increased, although brass pans with cords were still offered in catalogues of W.& T. Avery Ltd. in 1898 and 1906 for the use of apothecaries.



SCALES & WEIGHTS.

CHARACTER OF THE WEIGHTS, WITH AN EXPLANATION OF EACH

ʒ ij is Two Drachms, or 120 Grains.
ʒ i is One Drachm, or Sixty Grains.
ʒ fs is Half a Drachm, or Thirty Grains.
℈ ij is Two Scruples, or Forty Grains.
℈ i is One Scruple, or Twenty Grains.
℈ fs is Half a Scruple, or Ten Grains.

The Grains are distinctly marked [illegible] impressions on the thin weights stand for a Grain.
By a tea-spoonful is meant One Drachm [illegible] Half an Ounce [illegible] Two Ounces.

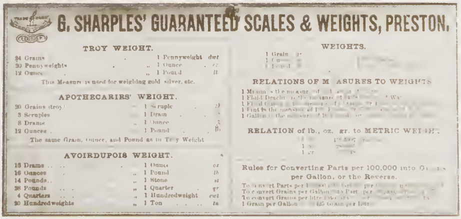
SPARKS, TREHARNE & CO.,
Wholesale and Export Druggists.
106, BUTE STREET, CARDIFF.
And at Barry and London.

FIG 7.

Cheaply-made pillar scales with crude metalwork, swan-neck beams and elementary oak boxes, Figs 25-27, were advertised for home medication and photography, c.1910, and the purchaser was offered brass or glass pans. After regulations were introduced, in 1907, these cheaply-made scales would not have been approved for professional use by apothecaries selling goods by weight. It is interesting to note that the authorities were undecided about scales and weights for dispensing - were they, or were they not used for trade? Their doubts arose because, as Roberts says (8), *"The patient pays for the compounder's skill in the price charged. It has not been decided whether the transaction is the purchase of the separate quantities of the ingredients mentioned (in the prescription), or whether it is merely the sale of a 'bottle of medicine', a 'box of pills' etc. The onus of proving that such instruments are not used for trade lies on the chemist"*.

The manufacture of apothecary scales was not a specialized industry; almost all non-specialized scalemakers made them or offered them for sale. Day & Millward, in their superb catalogue of 1889, offered roberval letter scales for chemists' and druggists' use. The illustrations in this article show a selection of the great variety of designs available to the customer.

In Part 2 of the article, the many designs of apothecary weights will be illustrated and their use discussed.



G. SHARPLES' GUARANTEED SCALES & WEIGHTS, PRESTON.

TROY WEIGHT.

24 Grains	1 Pennyweight	dwt
20 Pennyweights	1 Ounce	oz
12 Ounces	1 Pound	lb

This Measure is used for weighing gold silver, etc.

APOTHECARIES' WEIGHT.

20 Grains (troy)	1 Scruple	℈
3 Scruples	1 Dram	ʒ
8 Drams	1 Ounce	℥
12 Ounces	1 Pound	℔

The same Grain, Ounce, and Pound as in Troy Weight

AVOIRDUPOIS WEIGHT.

16 Drams	1 Ounce	oz
16 Ounces	1 Pound	lb
14 Pounds	1 Stone	st
28 Pounds	1 Quarter	qr
4 Quarters	1 Hundredweight	cwt
20 Hundredweights	1 Ton	tn

WEIGHTS.

1 Grain gr
1 Ounce [illegible]
1 Pound [illegible]

RELATIONS OF MEASURES TO WEIGHTS

1 Minim is the measure of [illegible]
1 Fluid Drachm is the measure of [illegible] Water
1 Fluid Ounce is the measure of [illegible]
1 Pint is the measure of [illegible]
1 Gallon is the measure of [illegible]

RELATION of lb., oz. gr. to METRIC WEIGHT.

1 lb [illegible]
1 oz [illegible]
1 gr [illegible]

Rules for Converting Parts per 100,000 into Grains per Gallon, or the Reverse.

To convert Parts per 100,000 into Grains per Gallon [illegible]
To convert Grains per Gallon into Parts per 100,000 [illegible]
To convert Grains per litre into [illegible]
1 Grain per Gallon [illegible] Grain per litre

FIG 8.

CAPTIONS TO FIGS 9 - 24

Fig 9. Steel beam, open box ends, brass pointer, glass pans, oak box, anonymous, c.1900.

Fig 10. Steel beam, box ends, brass pans, brass weights, 2,1,½ drachm, 2,1,½ scruples. Mahogany box, brass cover for grain weight locker engraved "Young & Son, Bear Street, Leicester Square" c.1820. (for detail of label see Fig 5.).

Fig 11. Steel beam, mother-of-pearl pans, black leather covered box lined with red velvet. Lid gold tooled with owner's name "Lord Vernon" Anonymous, c.1810.

Fig 12. Nickel (?) plated beam, black plastic pans, anonymous, 20th.C.

Fig 13. Steel beam, box ends, brass pans, apoth. troy and avoir weights. Label same as Figs 5 & 10. Young & Son, c.1820.

Fig 14. Steel beam, box ends, heavy glass pans, thick braided cords with gold thread balls. Mahogany box. Anonymous, c.1790.

Fig 15. Brass beam, open box ends, sliding weight on one arm which is graduated 0-4 x 1/10 g, horn pans, mahogany box lined with black velvet. Imported, shown in Gottlieb Kern & Sohn catalogue, 1900.

Fig 16. Iron beam, swan neck, brass pans, large size pans 75mm dia (3") suggest apothecary use, pierced pointer and square-section beam indicate date early 18th C.

Fig 17. Steel beam, box ends, brass pan and scoop, oak box, weights in cardboard box. W.& T.Avery Ltd, c.1900.

Fig 18. Brass beam & pan, cast iron base painted black with red and gold lines. Large weight moves over graduations 0-8 drachm, small weight over graduations 0-30 grains. Spirit level and levelling screw. Fairbanks, c.1920. Approval for dispensing was refused by Board of Trade because dirt in notches on beam could cause errors.

Fig 19. Steel beam, box ends, copper pan & scoop, avoir and apothecary weights. W.& T.Avery, c.1870.

Fig 20a & 20b Nickel (?) plated beam, open box ends, agate box fulcrum, glass pans, beam stamped Avery Patent, Class 1 To Weigh 2 oz. c.1900.

Fig 21. Steel beam, box ends, brass pans, pillar dismantles to fit into the mahogany box. Lever stamped "DeGrave, Short, Fanner & Co, London" c.1900.

Fig 22. Brass beam, continous knife edge 'stirrup ends', brass pans, universal pillar could accommodate alternative beams of several different sizes. Mahogany box. Imported, shown in the August Sauter catalogue, c.1925.

Fig 23. Brass beam, stirrup ends, brass weight pan, glass chemical pan, slide lift pillar is removable, but does not fit into the drawer (normal for this type). Lever stamped "W.& T.Avery Limited, Birmingham, Patent".

Fig 24. Brass lattice beam, agate box ends, fixed pillar. This type listed in the Avery catalogue of 1898 for "Grocers, Chemists, Apothecaries, Confectioners Etc."

Fig 1. (page 797). Apothecary scales from Fig 21, are shown with various other items from the pharmacy: Left, horn measuring beaker with graduations 2-16 fluid oz. Centre, pestle and mortar for grinding and mixing powders. Right, paper folding guide to fold paper into uniformly-sized packets. Front, paper packets each containing a single dose of medicine.

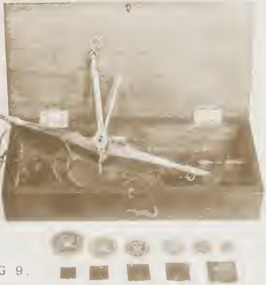


FIG 9.

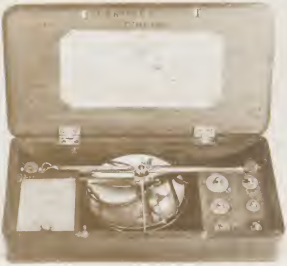


FIG 10.

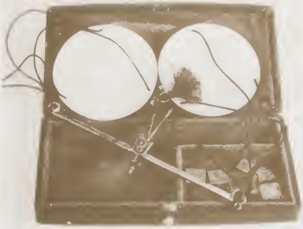


FIG 11.

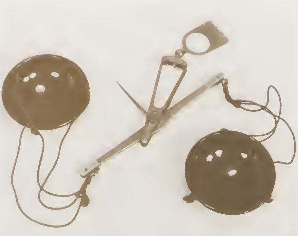


FIG 12.

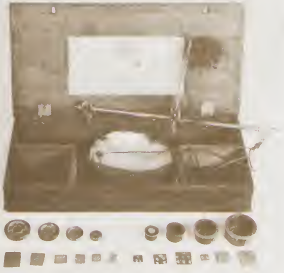


FIG 13.

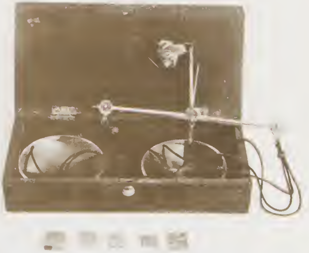


FIG 14.

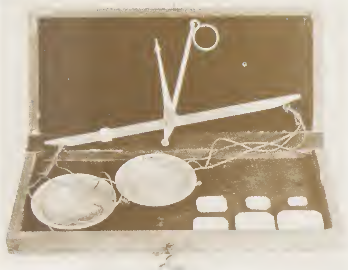


FIG 15.

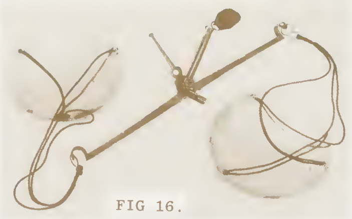


FIG 16.

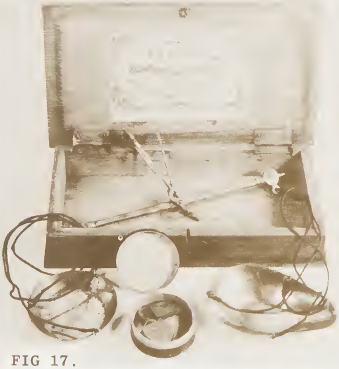


FIG 17.

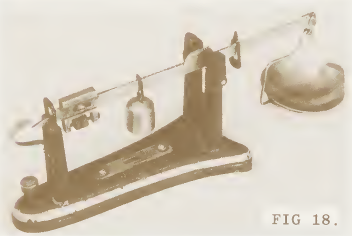


FIG 18.

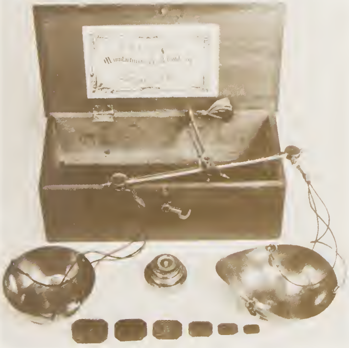


FIG 19.

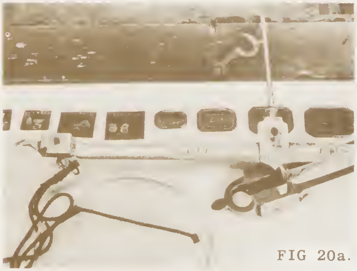


FIG 20a.

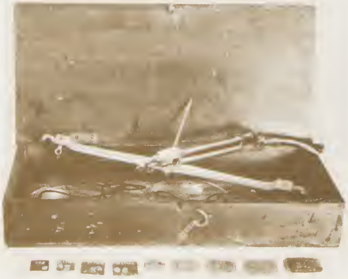


FIG 20b.

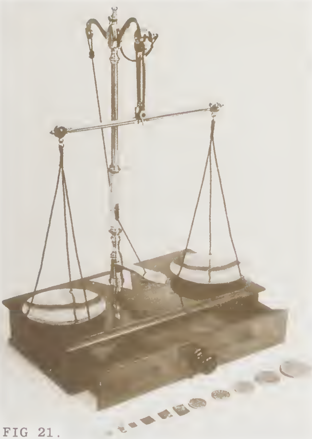


FIG 21.

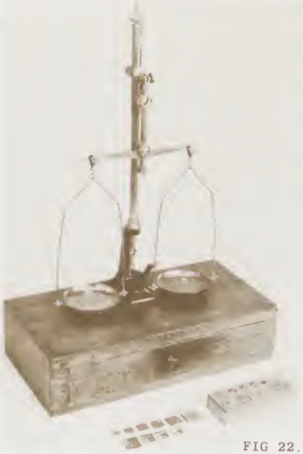


FIG 22.

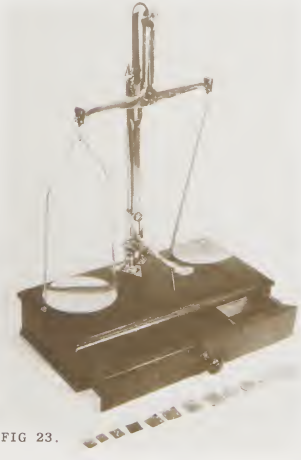


FIG 23.

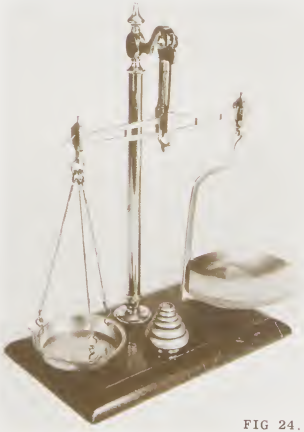


FIG 24.

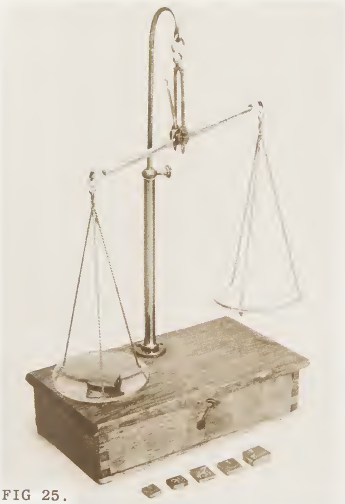


FIG 25.

Fig 25. Steel beam, swan neck, glass pans, telescopic pillar, oak box. Anonymous, c.1910. This type was cheaply made for home medication and photographic use.

Fig 26. Brass beam, swan neck, brass pans, telescopic pillar fixed inside the box (uncommon). Beam is stamped "Tivoli S.J.L.& C." c.1910 Use as Fig 25, above.

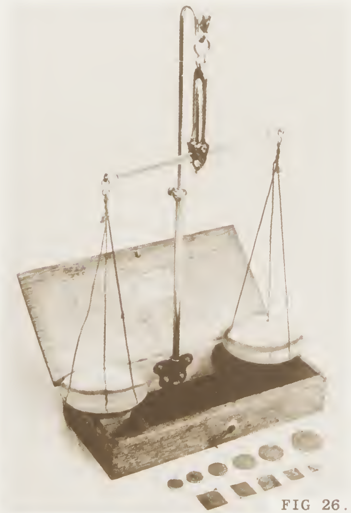


FIG 26.

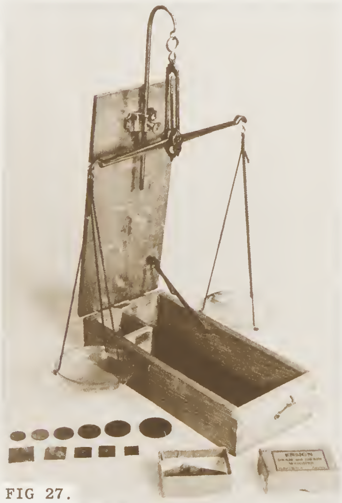


FIG 27.

Fig 27. Steel beam, swan neck, horn pans, adjustable pillar, oak box with hinge and stay at narrow end. Weights in cardboard box labelled "Ensign Dram and Grain Weights, London" c.1920. Probably used more for photographic chemicals than for medicines.

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Notes & Queries

NQ 78 MERCY MEYMOTT

query from George Mallis.

This scale was a real 'find'. It is an equal-arm balance in a made-up box with a full label intact; "Mercy Meymott, late Read, Scale Maker without Bishopsgate, London", with a table of coin weights. I cannot imagine anyone being called 'Mercy' but I suspect that may have been common in 18th century England. Sheppard & Musham record the name but only show the address 'within'. Do you have any information an this label ?

REPLY

from the Editor.

Mercy Meymott was, formerly, the wife of Joseph Read. After the latter died in 1764, she married Clement Meymott, ex-apprentice and successor to Read's business. He died a few years later, so Mercy carried on the business in her own name. I have recorded the address 'without', but have no dates yet. This term refers to an address outside the Bishop's gate in the old city wall. The Meymotts were at 64 Bishopsgate (within) and at 203 (without).

NQ 79 CURIOUS INSTRUMENT

note from Hans Jenemann

In NQ 76 (p.755) you gave an interpretation of the "curious instrument" of J.W.Piggott. I am not sure that this explanation is correct. I think it is possible to give another interpretation: that this instrument was a 'butter moisture balance' (in German Butterwasser-waage), used in dairies for the determination of the water content of butter, cheese etc, - see the enclosed illustration from a catalogue of c.1930.

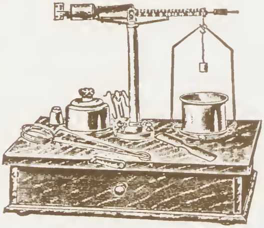
I suppose that Mr. Piggott's balance had a knife at the end of the beam. In this sense, it would have been correct to combine this balance with a pan. The function of such a balance is the same as that of the Westphal hydrostatic balance. In both cases, a loss of weight is determined - used as a hydrostatic balance the loss is due to buoyancy; used as a butter moisture balance the loss is due to the elimination of water.

Please note the graduations on the Westphal balance are from 0-10 (or from 1-9). Mr. Piggott's balance has many more graduations, but the photo is not clear enough to count them. The illustration from c.1930 also has many more, so that it was possible to determine water content to 0.1% when the butter sample was 50g.

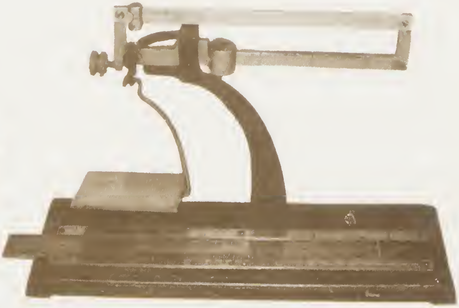
COMMENT

from the Editor

Thank you for your most interesting alternative explanation. The different graduations on Mr. Piggott's balance do seem to indicate a purpose other than specific gravity. Regarding the use of a pan with the knife-edge bearing, this was not the only possibility. I have illustrations from three different catalogues where the knife suspends the usual specific gravity plummet, and not a pan.



Butterwasserwaage



NQ 80 MOISTURE BALANCE MAKER

query from Emil Cohn Jnr.

Enclosed is a photograph of a 'moisture content' scale I recently bought. It has no manufacturer's name, but the name of a company that sold dryers is on the brass slide-rule attached to the base: "A.S.Nichols Co. Aeolian Hall, New York. Manufacturers of Dryers for Lumber, Veneers, Glued-up stock, Varnish, Paint & Fillers." Have you run across this type of balance at any time, and can you tell me the maker and approximate date of manufacture ?

Can any member help Emil Cohn ?

NQ 81 IRON WEIGHTS BY MELLARD; J.H. query from W.Binks.

I have two weights, both of seven pounds. One is an iron bar weight marked 7 pounds, which seems to date it pre-1907, the maker is MELLARD, a name not on your list. The other is of oval shape with the maker's initials J.H. The first weight has a rectangular plug hole underneath, and at one time, has carried a lead plug on top. The oval one, also a bar weight, has two square lead holes, one at each end, both marks unreadable. This also has a stamp mark on top. Can you give me any further information on dates and the makers ?

REPLY from the Editor.

I agree with you that the denomination, style and lead plugs on top of the weights suggest a date in the 19th century, but it is not possible to get closer than that, unless the makers can be traced. I have no record of a maker or retailer of the name MELLARD. The problem with J.H. is that I have too many men whose initials are J.H. To name just a few:- James Hardy, London; Joseph Hare, Birmingham; John Heath, Totnes; James Holt, Oldham; these firms, and several others, all advertised that they made or supplied weights, in directories of the late 19th century.

NQ 82 W.CHAMBERS DAY query from Gene Mahoney.

I recently bought a two-pan scale in an oak box. I thought I'd have no trouble dating it, but with my complete EQMs and Sheppard & Musham, plus Malter's catalogues, I failed. The label begins, "Patentee W.Chambers Day, Birmingham, Scale Maker to His Britannic Majesty and the Royal Mint." A bottom line states "Fine scales for Diamonds, Bullion and Experimental Chemistry". I presume the scale is of the Georgian era. Do your resources provide a date span for this maker ?

REPLY from the Editor.

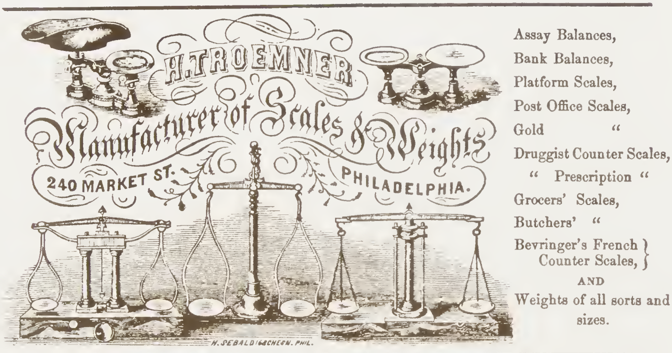
William Chambers Day was a scalemaker of 118 Suffolk Street, Birmingham, listed in directories from 1829 to 1842, then the firm became W.C.Day & Co. and subsequently Day & Millward c.1850, Day & Millward Ltd. in 1896 They were still in business in 1940. Your scale is apparently from the reign of George IV or William IV (who died in 1836). Pocket scales by this maker are very rare.

COUNT THE NOUGHTS !

Hans Jenemann has asked me to point out that in his article Precision Balance 9 (p.752), a Microgram should be 0.000001g (not 0.0000001g) and a Nanogram should be 0.000000001g (not 0.0000000001g). Editor.

Old Advert

Sent in by Emil Cohn Jnr.



H. TROEMNER

Manufacturer of Scales & Weights

240 MARKET ST.

PHILADELPHIA.

Assay Balances,
Bank Balances,
Platform Scales,
Post Office Scales,
Gold "
Druggist Counter Scales,
" Prescription "
Grocers' Scales,
Butchers' "
Bevringer's French Counter Scales,
AND
Weights of all sorts and sizes.

H. SEBALD 164 CHESN. PHIL.

Showcase

This special edition of SHOWCASE features rare weights from the collection of the Musée National des Techniques in Paris.

Figs 1a & 1b: Weight standard marked "VR 1 lb 1844 No.15". This weight copies the form of the Parliamentary Standard prepared by Prof. Miller in 1844. At that time, five platinum avoirdupois pound standards were made, one marked 'PS 1844 1 lb' (PS = Parliamentary Standard) and the others 'PC No.1 1844 1 lb (PC = Parliamentary Copy), and similarly for numbers 2,3 and 4. The weight illustrated appears to be No.15 of further copies supplied to foreign countries, in this case, France. (See article on pp. 390-394).

Figs 2a & 2b: Pot weight '1 lb' marked underneath "Copeland late Spode". This mark was used from 1847 (ref.G.B.Hughes). The lead has the verification mark of 3 scimitars in a shield, for Middlesex County. 5R above the shield represented the district of the county.

Fig 3: A set of weight standards for gold, silver and bronze coins, which was supplied to France, and was marked "Presented by the British Government 1870". Presumably, the weights were the ultimate aid to the detection of counterfeits.

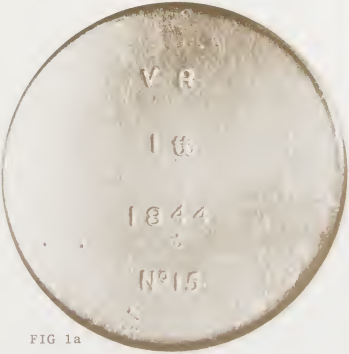


FIG 1a

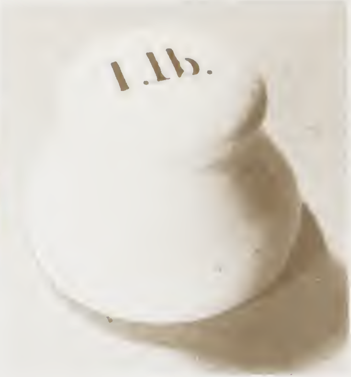


FIG 2a

Coll. et Cl. Musée National
des Techniques - C.N.A.M., Paris.

SHOWCASE

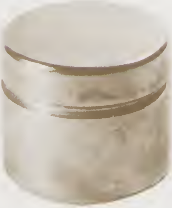
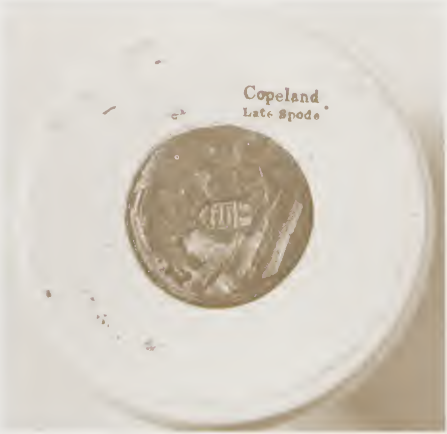


FIG 1b.



Coll. et Cl. Musée National des Techniques - C.N.A.M., Paris.

FIG 2b.

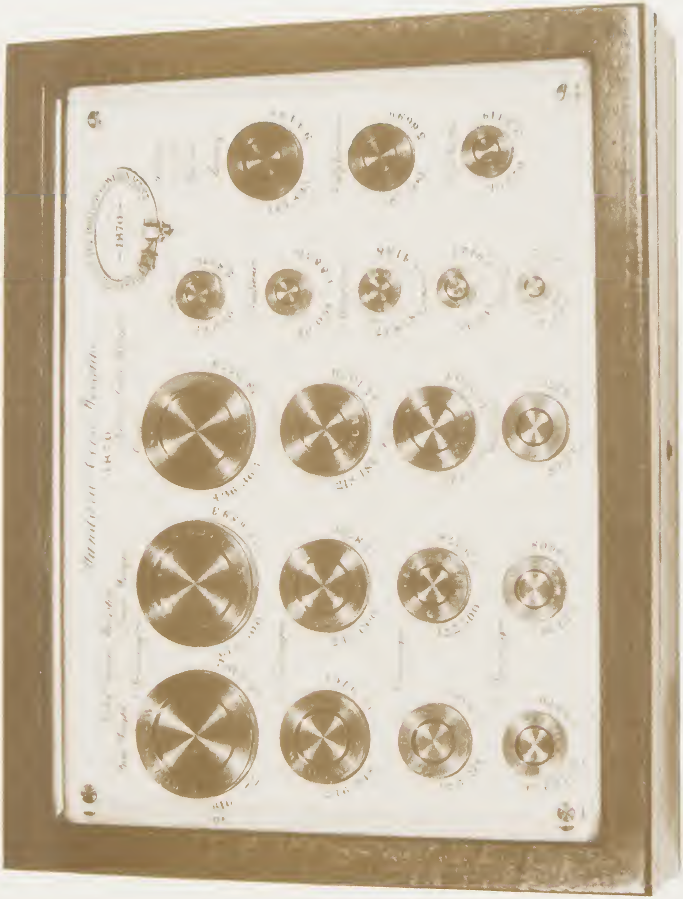


FIG 3. Coll. et Cl. Musée National des Techniques - C.N.A.M., Paris.

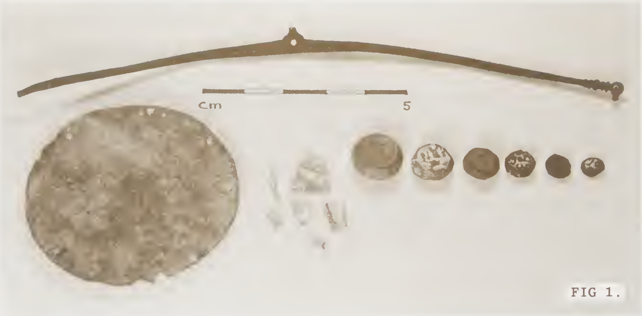


FIG 1.

An Ancient Coin Balance

LIONEL HOLLAND

The bronze balance-beam shown in Fig 1, was found at Caesarea Maritima on the Mediterranean coast of Israel. Though somewhat bent, it is almost intact, lacking only the pointer and the end of one arm. Its form is that of a typical late Roman coin balance, as described by Skinner (1), and illustrated by Sheppard & Musham (2). The pans were suspended from a wire loop passing through a hole in the end of each arm. The effective length of the entire beam would have been 160mm (6.3"), and the pointer (based upon the proportions of the coin balances illustrated by Sheppard & Musham (2), would have been about 50mm (2") long. The central suspension consisted of a horizontal pin, passing through the hole in the centre of the beam and riveted at each of its ends to the (missing) shears. The hole is worth a closer look: both sides are neatly countersunk into the middle of the beam, forming a knife-edge which rested upon the pin, Figs 2 & 3.

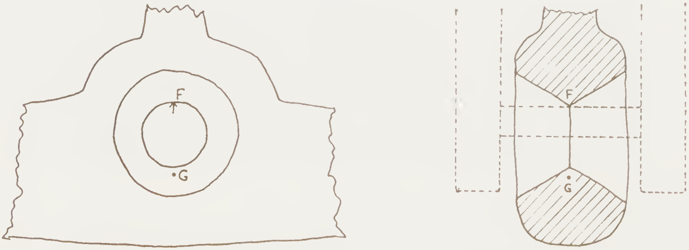
The pan is also of bronze. Though found separately, it is of about the proper size for this balance. It is 45mm (1.8") in diameter and weighs 7.5g.

By careful measurement (using a low-power microscope with a travelling stage and an eyepiece micrometer scale) we find that the distance between the fulcrum, or point of suspension (F), and the centre of gravity of the balance (G), is 1.5mm. This assumes that the balance-beam was dead straight, and the centre of gravity at its geometric centre. In practice, the position of the centre of gravity could be altered by bending the arms very slightly upward or downward.

Knowing the length of the balance arms, the mass of the beam (6.5g, including a correction for the missing bits), that of the pans (7.5g each) and the distance FG, we can calculate the sensitivity of the balance. This is the smallest increment in load on one pan which will produce a visible deflection (say, in this case, 1.5mm at the tip) of the pointer. The sensitivity of this balance (neglecting friction) works out at 0.029g with a load of 4.5g (the mass of the Roman gold solidus) in each pan. This figure agrees well with those given by Skinner (1) for the best Roman balances.

During the 7th century A.D., the Arabs conquered much of the Near East, including Palestine, and with it, Caesarea. They took over the technical achievements of Romano-Byzantine civilization and adapted them to suit their own purposes. Arabic systems of weights and coinage owe a great deal to their Roman predecessors.

In the Arab empire, the coinage was bimetallic, based on a gold unit (dinar) and a silver unit (dirham), which varied at different periods and in different places. Commerce required a great deal of weighing of coins. We do not know what Arabic precision balances looked like, for (according to Skinner, [1]) none have survived. Probably they were much like the balance described here - but considerably more accurate. We know this much from surviving Arabic coin-weights of glass, most of them produced in Egypt between 700 and 1400 AD. These were made with a precision not attained in Europe until several hundred years later. Ibn Ba'ra, an official of the Cairo mint in the 13th century A.D., describes weighings in gravimetric analysis carried out to within one-tenth of a "habba", or grain, i.e. about 6 milligrams (3).



FIGS 2 & 3. The centre of the beam showing how the fulcrum hole was countersunk from both sides. The missing shears and pivot pin are indicated by dotted lines

Figure 1 shows several cut fragments of Arabic gold coins. These were probably used for making payments in fractions of a dinar, or for making-up the weight of one or more whole coins to a pre-set figure. Also shown are a set of bronze weights for weighing gold, in denominations of one dinar (4.2g), 1/2, 1/3, 1/6, 1/12 and 1/24 dinar. All were found at Caesarea (4).

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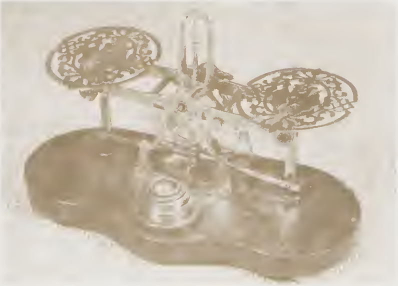
1. SKINNER F.G. 'Weights and Measures: their ancient origins and their development in Great Britain up to AD 1855' London 1967, p.73.
2. SHEPPARD T. & J.F.MUSHAM. 'Money Scales and Weights' London 1923, Fig 2.
3. EHRENKREUTZ A.S. 'Extracts from the Technical Manual of the Ayyubid Mint in Cairo: the Manuscript of Ibn Ba'ra' Bulletin of the School of Oriental and African Studies. Univ.of London, Vol.XV, pt.3 1953. p.435.
4. For a historical survey and description of many kinds of coin-weights and balances, including Roman and Islamic, see 'The Weighing of Money' by G.M.M.Houben, Zwolle, Hollond, 1983.

ACKNOWLEDGEMENT

I thank J. and S. Hendler for the opportunity to photograph and describe their balance-beam.

* * *

Letters



WHAT HAS THE CRIMEAN WAR TO DO WITH SCALE COLLECTING ?

Of course, you are looking at the photograph to see the meaning of this title, but please let me start by giving you some information about the Crimean war. Not one of our members is so old that he can tell you about it from his own experience.

The Crimean war broke out in 1853. The Emperor of Russia found a pretext for going to war. His real objective was to capture Constantinople and thus add that great Mediterranian port to his dominions. The war was declared against Turkey but this country immediately got help from England and France. It was a fight with heavy loss of life. The soldiers were short of food and inadequately clad. Here, Florence Nightingale achieved fame when she reorganised the hospitals. The Russians were besieged and finally, in 1856, the Treaty of Paris terminated the war.

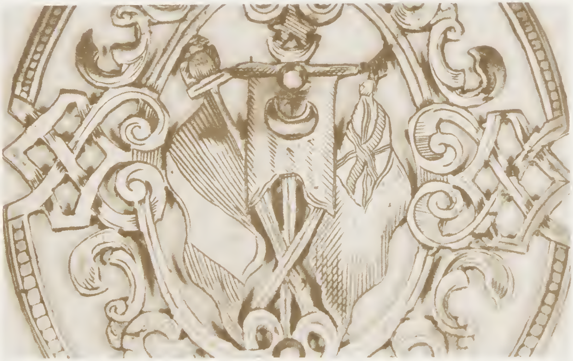
In commemoration of this war, I found an early S.Mordan & Co. postal scale (with every part numbered 5) completely engraved and the plates decoratively pierced. In the middle you will see the flag of Turkey with the star and the moon, next to it the flag of France and the ensign of England.

My question is this: Is there any collector among our members all over the world, who has a postal scale, or any other kind of balance, which has been made to commemorate a historical event ? I am thinking about wars, kings or other special events.

It would be most interesting to know whether there are more commemorative scales or is this one the only one in the world ?

Lou uit den Boogaard.

Perhaps early members remember Henry Hooper's postal bismar commemorating Rowland Hill's plan of penny postage which featured in the first issue of Equilibrium, page 2. If you have a commemorative scale please send the details to Lou. EDITOR.



AMERICAN PROJECT

Here is an interesting project for someone. The newspapers can be checked on microfilm or at the American Antiquarian Society, etc. The extract is from 'An Historical Account of Massachusetts Currency' by Joseph B.Felt, Boston 1839.

> 1708. April 26. At this period, before and afterwards, till the modern system of banking was adopted, almost every family who had money, would keep a pair of scales, to ascertain the value of their gold coin which they took and passed. Such advertisements as the subsequent one were common after newspapers began to be printed here. "All kinds of money scales made and sold by Caleb Ray, of Boston."

Eric Newman.

Its a great idea, Eric, this kind of research can be very rewarding.
EDITOR.

American Patent CCDs

A SERIES ON COUNTERFEIT COIN DETECTORS GEORGE MALLIS

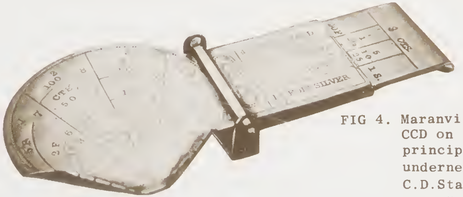


FIG 4. Maranville's little CCD on the steelyard principle. Marked underneath "Made by C.D.Staples, Worcester Mass."

H.Maranville of Clinton, Ohio, along with J.A.Thompson, each patented three separate CCDs. Thus, these two men accounted for six of the thirty patents granted.

Maranville's first patent was for a scale consisting of a graduated disk of metal with an extended arm and a slide supported on the extended arm, to form a scale beam with the slide arm acting as a movable counterweight. A simple fulcrum and base provided the necessary pivot for the scale beam.

The face of the disc is graduated into four sectors starting at a common point at one edge and extending to the opposite edge. Each sector is indexed with curved lines corresponding with the exact diameter of the coins. Raised tapered flanges at the focus point, suitably marked, will gauge the thickness of a coin. The extended arm is marked to correspond with the four sectors. The slide is marked in four columns, each column related to one of the sectors. Inscribed on each column is a mark to show the location to which the slide must be moved to weigh each particular coin.

To check a coin, the coin is first placed against the tapered flanges, and the curved line in the proper sector checked. This tests the diameter. Next, the appropriate mark on the tapered flange would give the proper thickness. Finally, the slide would be set at the mark for the coin in question to check its weight.

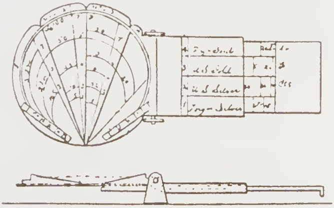


FIG 5. Patent No.16930 13th Jan. 1857. H.Maranville. The lower drawing shows how slender the instrument is, making it very suitable for carrying in the pocket.

This example of Herper's CCD was made without the index pointers and with no release lever. The essential beam design was used, but mounted in a different base. Marked "F.J.Herpers, Newark N.J. Patented Dec 29th 1857."

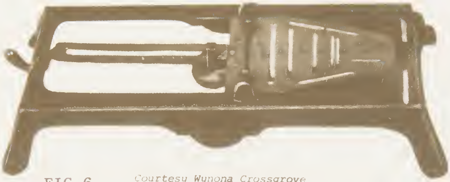


FIG 6. Courtesy Wynona Crossgrove and Barbra Fogler.

Herper's patent was for a more complicated device and consists of a base with two uprights attached thereto, and which act as a fulcrum for a counterweighted slotted coin plate. A stationary index is attached to one of the uprights and acts as a fixed reference. A swinging index bar is attached to the coin plate. The coin plate normally is at rest and can be activated by pushing down on a release lever to allow the beam scale knife to act on its fulcrum, similar in principle to modern chemical balances.

The slotted plate was designed to receive all the U.S. gold coins then current. The width and length of each slot would check the coin's thickness and diameter. The coin's weight would be judged against the counterweight balancing in the normal way.

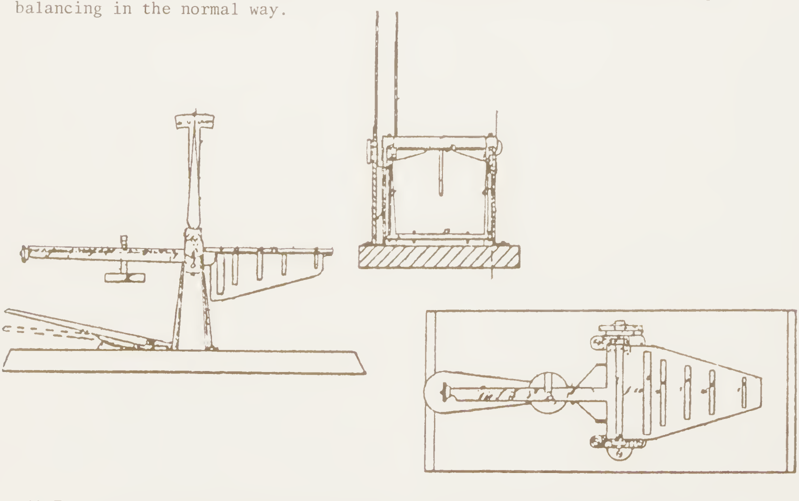


FIG 7. Patent No.18973 29th Dec. 1857. F.J.Herpers. This steelyard type balance has a disc-shaped weight suspended from the beam and a screw at the end to adjust the zero indication. In production, the design was much simplified - compare with Fig 5, above.

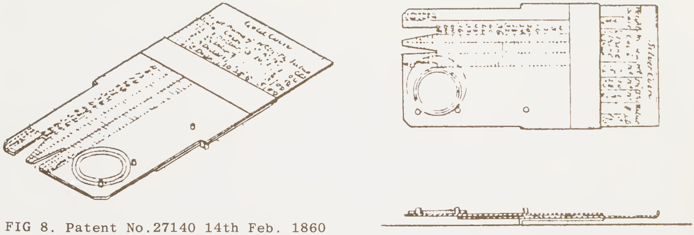


FIG 8. Patent No.27140 14th Feb. 1860
H.Maranville. Steelyard principle.

Maranville's second patent, somewhat similar to his first, consists of a fixed tray upon which the coin was placed, to be weighed against a movable slide calibrated for gold and silver coins. Calibration lines on the fixed tray indicated the proper coin diameter of genuine coins, in thirty-two parts to the inch. Two incisions in the outer edge of the fixed tray, each one half-inch deep and graduated along the edge, indicated the proper thickness of the coin. The calibrated movable slide has marked upon it the weight setting, diameter and thickness of each coin that can be tested.

Painter's CCD was the first to be patented for installation in a counter or other type of cash box. A slotted metal plate with a suitably sized opening for each coin then in use, was screwed on to a counter top. The size of the slot was such as to allow only coin of the proper diameter to enter. A vertical stop below the plate prevented a coin of improper thickness from descending the chute. At the bottom of the chute, below each slot was a counterweighted beam. Proper coins would trip the beam and allow the coin to fall to the bottom of the receptacle below. Spurious coins would either not fit the slot, get caught by the vertical stop, or fail to trip the counterweighted beam.

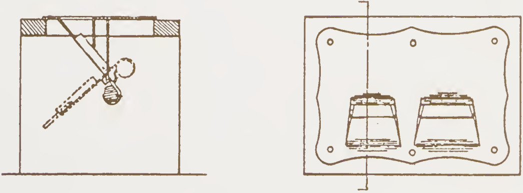


FIG 9. Patent 35834 8 Jul. 1862.
W.Painter. A small rocker beam is below each coin slot to test the weight.

EQUILIBRIUM®

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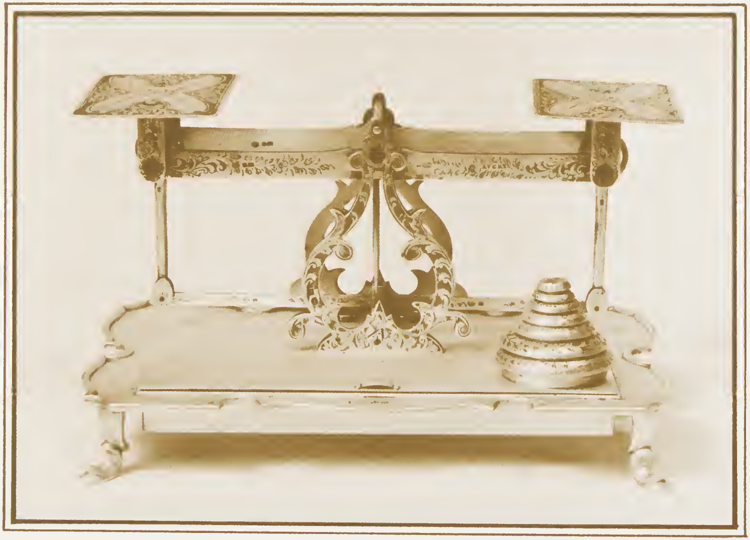

Editor's Comment

ISASC is honoured to include, in this issue, what is believed to be the first published history of the projection indication system for analytical balances. This system revolutionised the accurate reading of precision measurements and, in combination with air-damping, it eliminated the slow and tedious observation of a swinging pointer and the subsequent calculation of the mean value.

While it is realized that some readers may find this subject rather technical, it is hoped that they will take the opportunity to extend their knowledge by reading Hans Jenemann's excellent series of articles which explain, in small steps, how precision balances work and how the ideas developed to bring accurate weighing up to twentieth century standards. Weighing IS a technical subject, and pretty letter scales are only one facet of our fascinating hobby. Understanding all the aspects enhances appreciation of ones own collection and helps to place your favourite scales in the right perspective, be it aesthetic, technical or social.

Cover Picture

This elegant letter scale is made from solid silver (sterling) and is beautifully engraved with flowers and leaves. Each part is hallmarked with the stamp of John Round & Son, Ltd. Sheffield, 1901, and the front beam is stamped AVERY. The weights, 4,4,2,1,½,¼,¼ oz, normally fit inside the slim compartment on which they are standing, beneath the hinged lid. The base is 10" (260mm) long and the set weighs 64.5 oz (2007 gm). This fine set raises the question of who made what for whom ? The style and construction of the scale and weights is that of Samuel Turner, Snr. (STS), who was a known sub-contracter to W.& T. Avery, but the hallmark is for a Sheffield. silversmith.

Courtesy Bill Maresch.

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

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Oxford OX5 1NE England

c 1985 International Society of Antique Scale Collectors

USEFUL CONVERSION FACTORS

1 oz Avoir = 437.50 grains
= 28.35 grams
= 0.911 oz Troy
= 2.43 tola

1 grain = 1.22 grain (French)
= 64.79 mg
= 0.06479 gram
= 0.32399 CM

1 grain (French) = 0.83 grain (English)
= 53.11 mg

1 gram = 15.432 grain
= 0.035 oz Avoir
= 0.032 oz Troy

1 dram Av. = 0.4557 drachm Troy
= 27.34 grain
= 1.772 gram

1 drachm TR = 2.1943 dram Avoir
= 60 grain
= 3.888 gram

1 pennywt. = 24 grains
= 29.28 grains (French)
= 1.555 gram
= 1.20 scruple
= 0.4 drachm Troy
= 0.05 oz Troy
= 0.0548 oz Avoir
= 1.22 denier

1 assay ton = 32.667 gram

1 oz Troy = 480.00 grains
= 31.1035 gram
= 1.097 oz Avoir
= 2.67 tola

1 scruple = 20 grain
= 0.333 drachm Troy
= 1.296 gram
= 0.731 dram Avoir

1 carat Troy = 1.026 carat metrique
= 0.207 gram
= 3.168 grain

1 carat-metrique CM = 0.2 gram
= 200 mg
= 3.086 grain
= 0.974 carat Troy

1 gros = 72.0 grain (French)
= 59.01 grain (English)
= 3.824 gram

1 denier = 24 grain (French)
= 19.67 grain (English)
= 1.275 gram

1 tola = 180 grain
= 11.7 gram

1 pound Av. = 0.454 kg
= 1.215 pound Troy

1 pound Tr. = 0.373 kg
= 0.823 pound Avoir

1 kilogram = 2.205 pound Avoir
= 2.679 pound Troy

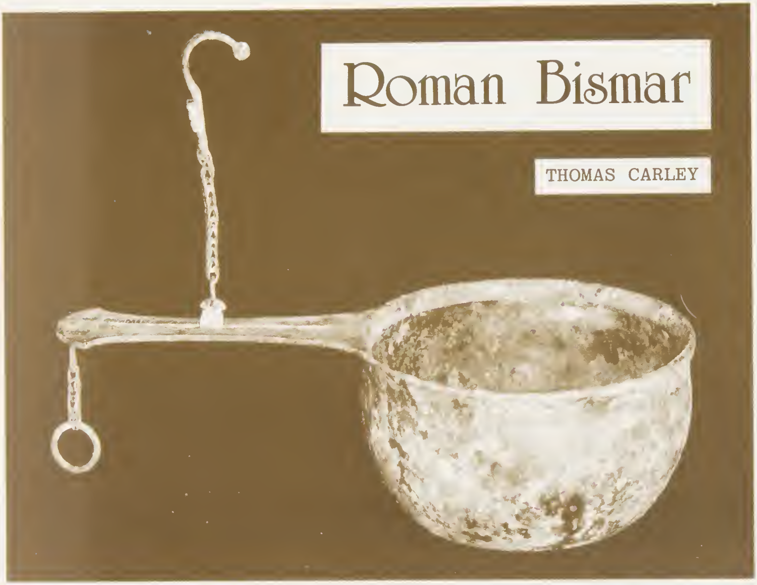
APOTHECARY SYMBOLS

℈iv ℈iv = 4 scruples
℈ij ℈ij = 2 scruples
ʒss ʒss = 1½ scruples (½ dr.)
℈i ℈i = 1 scruple
℈ss ℈ss = ½ scruple
℔ = 1 pound

ʒiv ʒiv = 4 drachm
ʒij ʒij = 2 drachm
ʒi ʒi = 1 drachm
ʒss ʒss = ½ drachm (1½ scr.)
℥ = 1 ounce

Roman Bismar

THOMAS CARLEY



This fine bronze weighing vessel was found in the ruins of Pompeii, a survival from the catastrophic volcanic eruption which engulfed that city in 79 AD, Fig 1.* It has an overall length of 267mm (10.5") and the diameter of the bowl is 143mm (5.6"). The flat handle was cast integrally with the bowl and has a slot down the centre. One side of the slot is graduated, and, as with bismars, the graduation marks get closer together towards one end, Fig 2. The weight is read against the fulcrum plate which slides in the slot, and which is used to suspend the instrument via a hook and chain. Hanging from the end of the handle is a chain and ring which originally must have suspended a counterpoise weight. The part of the fulcrum plate underneath the handle is about 5mm (3/16") wide, so it seems likely that the handle could not pivot freely on a part that wide. Perhaps the fulcrum was intended to be the ring at the top of the plate.

An accurate copy of this Roman ladle is in the Field Museum of Natural History in Chicago. The photograph, Fig 1, was taken by them for their Catalogue of Bronzes published in 1909. Therein it is described as a "Vessel for weighing liquid". ▷

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* *National Museum of Naples: catalogue No.74165.*

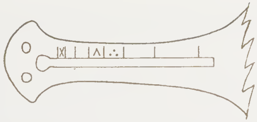


FIG 2. Graduations on the handle get closer together away from the bowl. The numerals do not seem to relate to the graduation lines.

COMMENT

MICHAEL CRAWFORTH

The basis for the museum description is not known, but it does not seem to fit the evidence. The graduations get closer together towards the end of the handle, and not towards the bowl - as one would expect if a load in the bowl was being weighed. This is consistant with the bowl end being of constant weight. It suggests that the load being weighed was originally suspended from the chain at the end of the handle, and that the empty bowl was the counterpoise weight. Could it be that it was a combination instrument - a bismar for weighing and a volumetric measure ?

Notes & Queries

NQ 83 BARTLETT OF BRISTOL

query from Gene Mahoney

I have found a nice Bartlett of Bristol scale, the same as Avery's on page 7 of Equilibrium, with an 11 inch beam and two 1 pound weights, 8,4,2 and 1 ounce, apparently not adjusted since Victoria's time. Any information about this maker would be appreciated.

REPLY

from the Editor

Bartlett of Bristol is a difficult name to date because the firm was in business for many years. Although their name changed several times, Bartlett was used for all of them ! John Bartlett, 1831-1852; John Bartlett & Son, 1853-c.1883; Bartlett & Son Ltd, 1890-1910. The firm was absorbed by Henry Pooley & Co. Ltd of Liverpool, in 1910, but the name continued for some years. The design of your scale could go back into the last quarter of the 19th century.

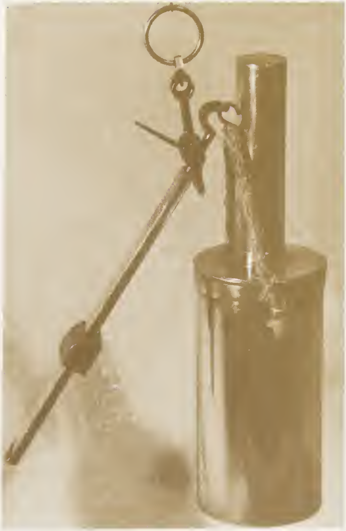
NQ 84 GRAIN SCALE

query from John Cattle Snr.

In my quest for grain measuring and weighing devices, I acquired this German scale. I do not understand the reason for, or the use of, the top portion which screws onto the bucket. Any information about the scale and its maker would be appreciated. The scale is marked F.A.THIELE KIØBENHAVN and has the number 4263.

REPLY

from Norbert Schwermann



You have a Danish grain scale, but it was made for the old East German area near the Baltic sea, especially the area of the towns Rostock, Mecklenburg, Starland and the region of Neu-Vorpommern. The scale was made by F.A. Thiele of Store Kjöbmagergade Nr.39, Copenhagen. Thiele obtained a patent for this scale because it was a special unequal-arm design.

Your scale has the serial number 4263 (I have a similar scale, No.4355). On the beam there are two sets of graduations, one is marked P/HL for Pfund per HectoLitre, which is metric. The other is marked LP/D for Liespfund per Drömt, the old system used before metrication in 1872. However, in the grain trade the old units continued in use for many years. Your scale can be dated around 1875.

The narrow cylinder on top of the lid was used to contain part of the beam when it was stored inside the bucket for easy carrying. It was also possible to use the cylindrical top as a striker for levelling the grain before weighing.

NQ 85 JOCKEY WEIGHT

query from Reiner Rix

Enclosed is a picture of an English lead weight, which was said to be a jockey weight when I bought it some years ago. If the weight of the jockey was not sufficient for his class he had to take such weights with him during the race. The size is 165 x 72 x 7 mm.(6.5 x 2.8 x 0.27"). On top a leather strip is fixed with a copper plug. The weight is marked 2 LB, (actual weight) HRB (name of a jockey ?) and Whippy, Stegall & Co. North Audley St. London. Do you know this type ? Can you date it ?

REPLY

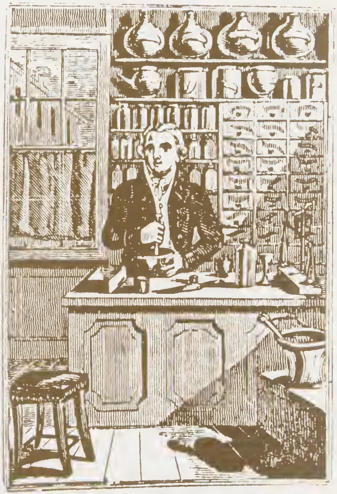
from the Editor

I have traced the name on the weight: Whippy Steggall & Fleming up to 1918, Whippy Stegall & Co. in 1919, then Whippy, Stegall & Co. Ltd. So, your weight is dated to one year ! HRB could be the jockey, but could also be a racing organisation like Harrogate Racing Board.

English Apothecaries Scales & Weights

PART 2 : WEIGHTS

MICHAEL CRAWFORTH



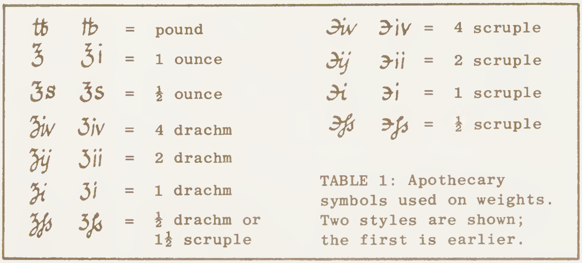
Apothecary.

INTRODUCTION

It seems that the 18th and 19th century English apothecary's shop was a scene of metrological confusion, with apothecary weights and avoirdupois weights lying side-by-side, one or other to be used according to the task in hand. Originally, it was intended that all medicines should be weighed by apothecary weights, but the ingredients, in their basic unmixed state, were not medicines and therefore had, by law, to be weighed by avoirdupois weight. So, when the apothecary bought his raw materials from the wholesale chemist or druggist, he bought by avoirdupois weight. When he subsequently divided up the materials for making medicines, he continued to use avoirdupois weight because, presumably, it was more convenient. So, it became the custom for apothecaries to use avoirdupois weights for all quantities over a quarter of an ounce. For lower quantities, they used apothecary weights because of the smaller sub-division of the ounce.

Further complications arose because prescriptions and receipts were usually specified in apothecary weight. This custom required the apothecary to convert the values, by calculation or by tables, to avoirdupois weight for compounding his medicines. The situation was well summed-up by Charles Wilson, in 1859:-

▷



℔	℔	=	pound
℥	℥i	=	1 ounce
℥s	℥s	=	½ ounce
ʒiv	ʒiv	=	4 drachm
ʒij	ʒii	=	2 drachm
ʒi	ʒi	=	1 drachm
ʒſs	ʒſs	=	½ drachm or 1½ scruple
℈iv	℈iv	=	4 scruple
℈ij	℈ii	=	2 scruple
℈i	℈i	=	1 scruple
℈ſs	℈ſs	=	½ scruple

TABLE 1: Apothecary symbols used on weights. Two styles are shown; the first is earlier.

> *"...thus three different systems became contemporaneously established in their laboratories. By the first, they made all their purchases, and retailed all their wares, when amounting to a quarter of an ounce in quantity or upwards, according to the avoirdupois scale; by the second, they dispensed prescriptions, merely a form of restricted sale, ...according to the troy or apothecaries standard; and by the third, they mingled the two, receiving the directions in troy, and transmuting them for execution into avoirdupois."*

To add to the confusion, the names of the weights in the two systems were, in some cases, the same, although the actual mass was very different. Thus, the avoirdupois pound was heavier than the troy pound, the avoirdupois ounce was lighter than the apothecary (troy) ounce, and the avoir dram was lighter than the apothecary dram. Scruples were a part only of the apothecary system, and grains were common to both systems.

It is hardly surprising that this state of affairs led to difficulties, and Wilson (10) reported that the apothecaries, themselves, admitted that it was ".. *a continual source of confusion and inconvenience, and adds a perpetual excuse or occasion for carelessness in young dispensers."* In spite of several authoritative recommendations for improvements, by such men as Charles Wilson (10), and the abolition of apothecary weight by the Medical Act of 1858 (13), the use of drams and scruples continued alongside avoirdupois weights. The Medical Council made an attempt to introduce the metric system in the 1860s, but due to strong opposition, the proposed mandatory change was reduced to a permissive option. So, the only outcome was the publication, in the 1869 British Pharmacopoeia, of conversion tables for the metric system and the recommendation that it be used for dispensing. But, without.the simultaneous and coordinated change to metric weights by other trades, such as wholesale chemists and druggists, their adoption only by apothecaries would have made an already confused situation more complex. The necessary coordinated change by all trades was not forthcoming.

One consequence of the Medical Act of 1858, presumably unforeseen by the authorities, was that some physicians, not wanting to use the now illegal apothecary values, chose to prescribe in grains. In this way they also avoided the metric system which was strongly criticized for its inability to be successively divided by two. So, during the second half of the 19th century, apothecary weights were often made with the mass in grains on the reverse of the traditional symbols, or the denomination in words.

While it is probable that a few apothecaries adopted metric weights for dispensing in the 19th century, it seems that it was not a general practice until the 20th century. The catalogue of W.& T.Avery Ltd. did not include metric weights specifically for apothecaries until 1916, when they listed *"Metric standard weights: to comply with the new tabulation of the British Pharmacopoeia"*.

Even if the apothecary was careful to use the correct weight system, errors could arise from the inaccuracy of the weights. There was no national standard, no independent verification after manufacture, and no periodic inspection, of apothecary weight, until the Act of 1878. As a result of this Act, standards for apothecary weights were introduced in 1879, and to show that weights conformed to the requirements, the term 'Standard' was sometimes marked on the weights. In their tests of many weights in the Wellcome collection, Crellin & Scott (2) found that only 50% met the requirements of the 1879 Standard, and 3% had a gross error of 25% or worse !

Confusion arises, today, from the use of the names 'dram' and 'drachm' on apothecary weights of the 18th and 19th century, but this was NOT a problem at the time. They were simply alternative spellings of the same word (dram from the Middle French, drachm from the Latin), and they were used for both avoirdupois and apothecary weights, as shown by this dictionary definition of 1754:-

> *"DRACHM or DRAM: the 16th part of an ounce avoirdupoise; with apothecaries, it is the 8th part of an ounce, and is equal to 3 scruples or 60 grains."*

Our puzzlement arises from the early 20th century attempt to reduce the confusion by reserving the spelling 'dram' for the avoirdupois weight of 27.34 grains, and 'drachm' for the apothecary weight of 60 grains.

WEIGHTS

As most apothecaries used avoirdupois weights for quantities of over a quarter-ounce, typical English sets of apothecary weights comprise 2,1,½ dram, and 2,1,½ scruple. Weights of 4 dram and 1 ounce are rare. However, in the larger scale boxes for hand-held balances, and pillar scales, it is common to find weights for 2,1,½ ounce avoirdupois. The catalogues of W.& T.Avery, from the 1830s to 1912, list sets of apothecary weights as described above, Fig 35, and sometimes include a 1½ scruple weight (the same as ½ dram). Larger denominations of apothecary weights were not offered, although some were made by other companies, Figs. 5,10,25 & 41.

It is also common to find pennyweights in apothecary scale boxes, and it is clear that these, too, added to the profusion of weight systems used for dispensing. Of course, both pennyweights and apothecary weights are subdivisions of the troy ounce, and one fine set of bronze apothecary nesting weights, recorded by the author, is marked on the largest cup *"1 oz. or 8 Dram Troy"*. The other cups are 4,2,2 dram, Figs. 40 & 41.

The traditional design of apothecary weight was a flat square with symbols for the denomination on one or both sides, Fig 1. The meaning of these symbols is shown in Table 1. It was a very practical design in most respects, and weights of this type were available throughout the 18th and 19th centuries, and they were still shown in the Avery catalogue of 1898. Variations of the square pattern included the use of the symbol on one side and the name on the other, Fig 1, or the name on one side only. Traditionally, the symbols or names were stamped into the surface of the weights, but in the late 19th century, embossed designs were produced, Fig 10. The main disadvantage of the square design was that the corners were vulnerable and susceptible to rapid wear. To avoid this problem some weights were made in disc form.

In an attempt to produce distinctive weights of greater accuracy, less subject to wear, W.& T.Avery introduced round weights of coin-like appearance, Fig 24. This design was registered in 1847. In 1850, Avery registered a further design, the lozenge shaped weight, Fig 16. Weights of both designs were nicely made and became very popular, in spite of the criticism that dirt could collect in the embossed surfaces and make the weights inaccurate. Avery made several different designs for the obverse and reverse of these weights, some included their name in full, others just the initials W.& T.A. Weights of similar design marked H.& S. may refer to Hodgson & Stead, a firm of scalemakers taken over by W.& T.Avery in 1913. Equally well-made weights were made by W.C.Day & Co. in the form of concave-sided rectangles. Although these are listed in the large 1889 catalogue of Day & Millward for drams and scruples as well as for pennyweights, the author has only seen pennyweights. Day's design was first registered in 1853.

Cheaply-made weights, of coin-like form and of inferior appearance, were made in large quantities and were marked J.L.B., Fig 25. This firm has not yet been identified, but the attribution to an American source, by Kisch, seems doubtful, in view of the vast number of the weights in Britain. Rare examples of the lozenge type are marked J.B.B., Fig 18. Round weights of rather better quality were made in large numbers by P.Rogers & Co. This firm, too, was mentioned by Kisch in his American section, but actually Peter Rogers & Co was a well known firm in Birmingham, England. In the mid 18th century, John Kirk of St.Paul's Churchyard, London, famous for his beautiful coin weights, advertised that he also made *"a curious* Set of Drams & Scruples for Apothecarys &c"*. No apothecary weights signed by Kirk have been seen by the author.

The vast majority of apothecary weights were made of brass. A few have been seen made of brass and plated with nickel, and a very few from aluminium, Fig 5.

It is not intended to illustrate or discuss the avoirdupois weights or troy pennyweights used by apothecaries, in this article. They will be covered more appropriately in articles about trader's and jeweller's weights. The great variety of apothecaries weights is shown in the following illustrations.

** In the 18th C. 'curious' meant well-made.*

REFERENCES (relevant references are repeated from Part 1)

2. CRELLIN J.K. & J.R.SCOTT: 'Drug Weighing in Britain 1700-1900" Medical History, Vol XII No.1, Jan.1969.

10. WILSON Charles: 'Observations on a Proposed Adjustment of Weights and Measures for the New British Pharmacopoeia' Trans Pharmaceutical Jnl. Vol.1 (2) p.18-28, 1859-60.

13. ANON: 'Standards Commission 2nd Report' 1869 'On the Question of the Introduction of the Metric System of Weights and Measures into the United Kingdom' H.M.S.O.

NOTES ON THE ILLUSTRATIONS

FIG 1. Traditional square weights used throughout the 18th and 19th C. Apothecary symbols on obverse only, or on both sides. 'ʒ' means dram; 'ij' is two; 'ſs' is two ss, which means semis, or half; '℈' means scruple; 'ß' also means half.

FIG 1a. The same design as above on the obverse, but with words and figures on the reverse, used in the 19th C.

FIG 2. Same obverse and reverse, but different symbol style. Sometimes words and figures on the reverse. 19th C. i & j = 1.

FIG 3. Two drams weight with a 'flower' stamp. 'M' is two ii joined.

FIG 4. Engraved examples are uncommon, late 18th & early 19th C.

FIG 5. Aluminium weights with verification/inspection stamp 54 (for 1954).

FIG 6. Early 20th C. weights. The uneven border is characteristic of cheap mass-produced weights for the domestic market.

FIG 7. Half-scruple with Victorian stamp, crown VR 197 (Brighton). Half-dram with Westminster stamp, a portcullis, with 1826 above.

FIG 8. One dram with Elizabeth II stamp, crown E II R 65 (Wolverhampton). and date stamp 64 (for 1964).

FIG 9. Two dram weight filed for adjustment. 'ij' is two ii, or two.

FIG 10. A 'set' of 20th C. mass-produced weights. The 4 drachm has a date stamp 40 (1940) and a cancellation star. The one drachm has the stamp of Edward VII, crown 2 ER (2 = London).

FIG 11. A set of 20th C. weights with denominations in grains rather than the names drams and scruples. The mass values remain the same.

FIG 12, 13, 14, 15, 16, 17, 19 & 20. Several variations of W.& T.Avery's lozenge design registered in 1850: 16 has initials W.& T.A.; 17 has only A for Avery; 19 & 20 show the mid-20th C. design with thick rims - they lack the fine quality of the 19th C. design. 16 & 17 have the diamond registration mark. (see ISASC Handbook).

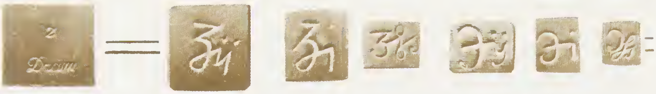
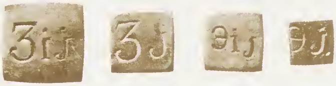


FIG 1.



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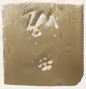

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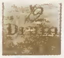

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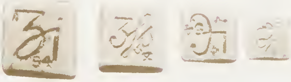

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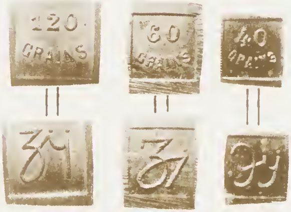

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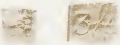

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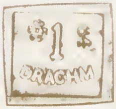

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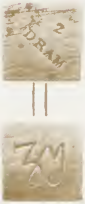

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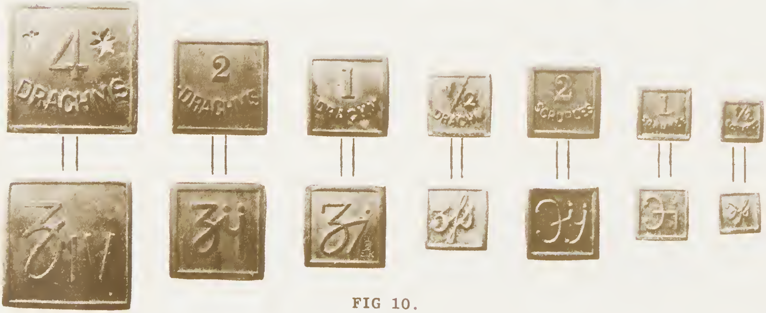


FIG 10.

FIG 18. A copy of Avery's lozenge design, signed J.B.B. (This maker has not yet been identified). "Standard" refers to the standards for Apothecary weights introduced in 1879.

FIG 21 Handsome, but anonymous weights. The half-dram ahows a variation in design with the denomination split between top and bottom, instead of the rosettes at the bottom of the other weights.

FIG 22. Another elegant but anonymous design.

FIG 23. Plain round weights were used concurrently with the traditional square design (Figs 1 & 2), but less commonly.

FIG 24. Avery's coin-like weights marked on the obverse "Apothecaries Weight Registered March 16, 1847 W.& T.A."

FIG 25. A set of apothecaries weights by J.L.B. (maker unidentified). These weights, from two drams down, are very common in England. The large 1 and ½ ounce weights are very rare. Note the odd spelling of ounzes, instead of ounces.

FIGS 26, 28 & 30. Several variations of Peter Roger & Co's design, one giving his address, Birmingham (England).

FIG 27. Two drachms by H.& S. (possibly Hodgson & Stead of Manchester).

FIG 29. Four drachms by W.& T.Avery.

FIG 31. Large flat four dram weight with cancellation star.

FIGS 32, 33 & 34. Further variations of round apothecary weights.

FIG 35. Traditional weights from the W.& T.Avery catalogue of the 1830s.

FIG 36. Avery's lozenge shaped weights from their 1912 catalogue.

FIG 37. Knobbed brass weights from the scale box of Young & Son, (see EQM p.804 Fig 10). Such knobbed weights are rare.

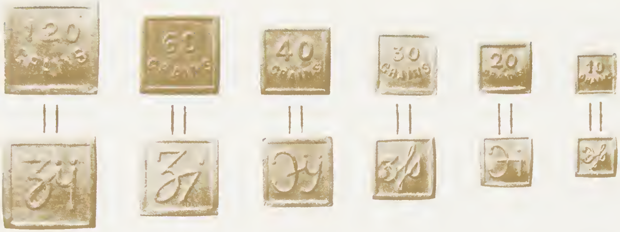
FIG 38. Rimmed stacking weights for apothecaries are very rare. Victorian stamp, crown VR 2 (London).

FIG 39. Avoirdupois weights used by apothecaries are usually indistinguishable from those used by grocers and other traders. This example is unusual in being marked "C.W.S DRUG DEPt." (Cooperative Wholesale Society). Stamp for Elizabeth II, 370 (Smethwick).

FIGS 40 & 41. A set of apothecary nesting weights made in'bronze', The large cup is engraved "1 oz or 8 Dram Troy" English, very rare.

ACKNOWLEDGEMENT

The author thanks Mr.Eric Parrish, Curator of the Avery Historical Museum, for supplying information to help with this article.



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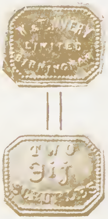

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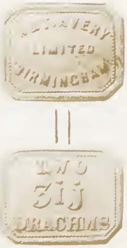

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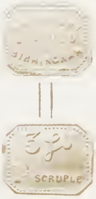

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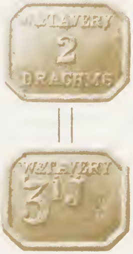

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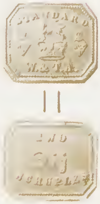

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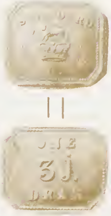

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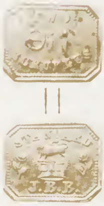

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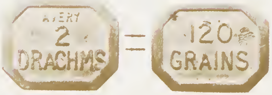

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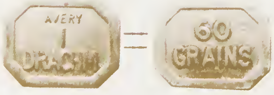

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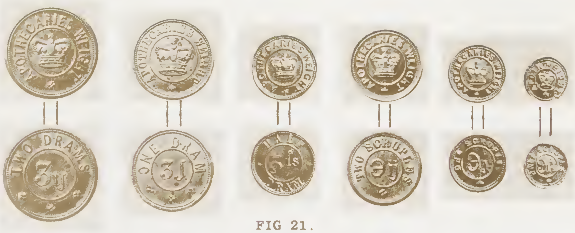

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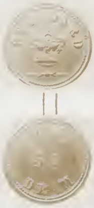

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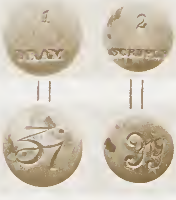

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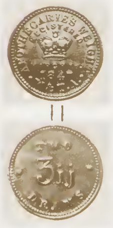

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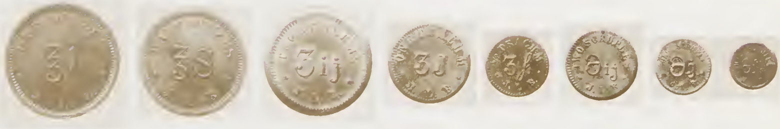

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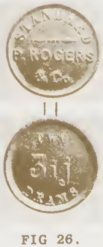

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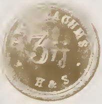

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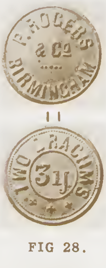

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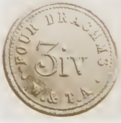

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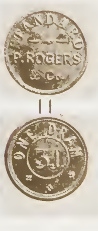

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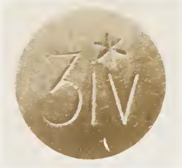

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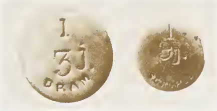

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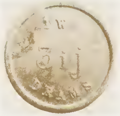

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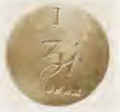

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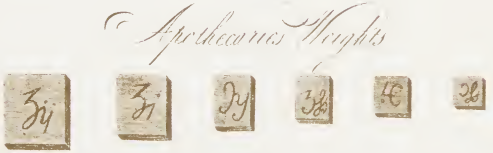

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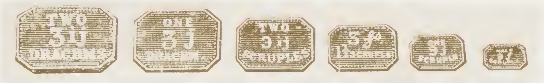

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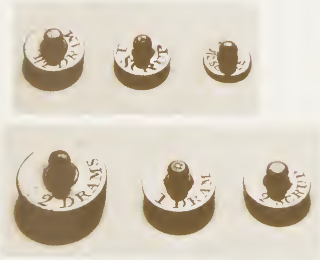

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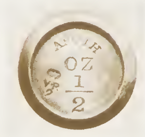

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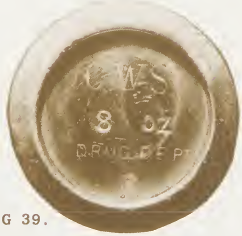

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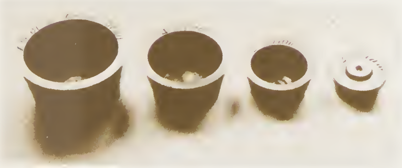

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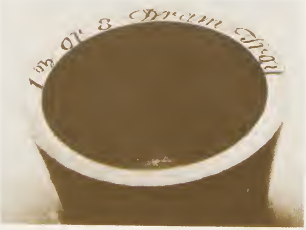

FIG 41.

Projection Indicators

HANS JENEMANN

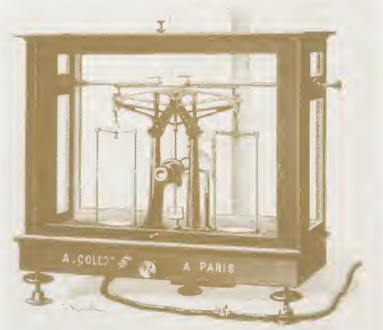

FIG 1.

The first person to use optical projection to indicate deflection from the zero position of the pointer (i.e. the inclination of the beam) was A.Collot Jnr (1827-1900) in Paris, as early as 1891. In this early stage the light beam was produced by a gaslight burner. The gas pipe leading to the balance can be seen in Fig 1, and the burner is shown in Fig 3, item E. This system was reported in the scientific journal 'Comptes Rendus' 112 (1891 pp 99-101), but at this stage, the balance had not yet got air-damping.

Collot's projection system is shown in Fig 3, as published by himself, in the journal 'Bulletin de la Société Chimique de Paris' (1891 pp 98-100). The gaslight E was behind the case of the balance, and the light, after passing through an aperture, was collected by an optical convex lens D. It passed through a little glass plate which was fitted into a rectangular frame near the end of the pointer. In the middle of this glass plate a fine line was marked. When the balance beam was swinging, the optical image of this line was projected to the microscope B, in which a micro-scale was fixed. In this way, the line of the pointer was swinging from left to right on the micro-scale. This image was magnified by lens F and could be seen easily on a translucent ground glass screen at the front of the microscope.* Collot produced a good number of balances with his optical projection system, and one of these instruments was shown at the International World Exposition in Paris in 1900.

In 1910, Erich Sartorius (1876-1947) of Goettingen, son of the founder of the firm, Florenz Sartorius (1846-1925), obtained German patent No.238891 for his projection system for analytical balances. He changed Collot's device in the following way: The micro-scale was fixed in the frame at the end of the pointer, instead of the line mark. The micro-scale was illuminated from the front of the balance, and the image of the swinging micro-scale could be seen, with good optical enlargement, on a broad glass screen 'e' below the beam, Fig 2. This manner of directing the light beam is a little like Paul Bunge's autocollimation tube (see Precision Balance 10). However, for a long time, the Sartorius company seems not to have produced balances with Erich Sartorius' patent projection system.

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* *It should be noted that optical projection had already been used in electrical measurement apparatus.*

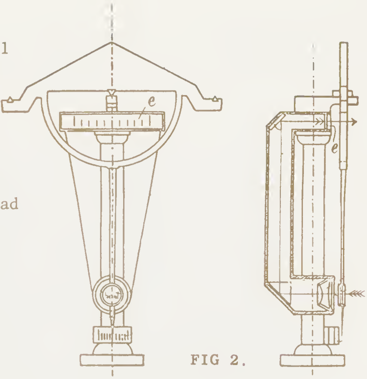


FIG 2.

In 1929, we find in the catalogue of Becker's Sons, an optical projection arrangement similar to Collot's, but using the light beam from a little 3 volt lamp (instead of a gaslight burner) installed directly behind the column for the beam. This places it in the middle of the balance case - surely problematical due to the creation of heat by the lamp. The direct current for the lamp came from a transformer by little wires from outside the case. The condensed light beam passed through a hole in the column and then through the glass micro-scale at the end of the pointer, as arranged by Sartorius. Soon afterwards, Becker's Sons changed the design again. The image of the swinging micro-scale was projected to a translucent ground glass screen at the top of the optical system in front of the column, as shown in Precision Balance 11 (page 843).

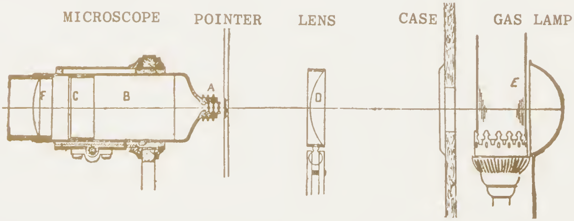


FIG 3.
Collot's gas lamp projection system (section)

It was only in combination with a perfectly working air-damping system (as on Becker's Sons balance) that optical projection became a significant improvement. The beam was rapidly brought to a standstill and the image of the projected micro-scale could be observed, stationary, against the datum line (or a nonius) on the ground glass screen. Without damping, the swinging had to be recorded (see Precision Balance 3, p.589). Thus, the combination of optical projection with air-damping, provided rapid and accurate reading of the small weight values, without calculation.

Charles Dickens' Scale

LEWIS S. WEISS

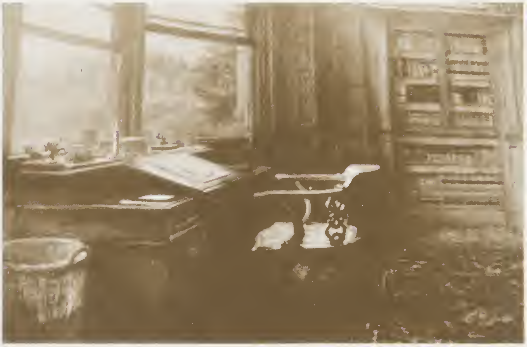


FIG 1.

As Charles Dickens, the author, was reported to have written about 20,000 letters during his lifetime (1), it would be almost a necessity for him to have a postal scale - and he had. Dickens' scale is a candlestick letter scale made by R.W.Winfield of Birmingham, England, and it is marked on top "Registered September 5, 1848", Fig 2. The cylinder is a light green glass, probably Bristol Milk glass (see EQM pp 403-405), with the graduations marked in gold straight on to the glass, and a brass rim around the foot altogether an elegant addition to the desk.

The history of Dickens' scale can be traced, but there are a number of gaps and blank pages in the story. Dickens received the scale as a gift sometime around 1854, according to the authentication in the Philadelphia Library signed by Georgiana Hogarth, sister-in-law of Charles Dickens. Her certification reads as follows:-

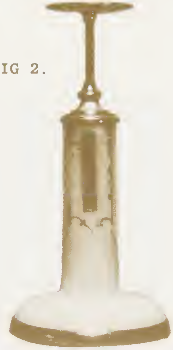
> *"I certify that this letter weight* [sic] *was presented to Charles Dickens by a friend from Cornwall about 1854. It always stood on his writing table up to the time of his death in 1870 - and since then it has been on my writing table. - Georgiana Hogarth."*

The contents of Dickens' home at Gads Hill, near Strood in Kent, were sold on two days, 10 Aug. 1870 and 8 Nov 1878. However, there is no mention of the letter scale in either inventory, nor is there any indication of who the purchaser might have been (2). Yet, shortly after Dickens' death, Sir Luke Fildes painted a picture of Dickens' study, entitled 'The Empty Chair' Fig 1, in which the light green candlestick scale is prominently displayed on the desk.

In 1914, Harry B.Smith published a catalogue of his treasures entitled 'The Sentimental Library' (3). Included in this catalogue is a picture of the lamp on Dickens' desk, but there is no specific mention of the scale. However, the authentication for the lamp, included in the catalogue, is similar to the certificate for Dickens' scale. Therefore, one must conclude that the scale followed the lamp into Smith's possession.

Dr. A.S.W.Rosenbach, of Philadelphia, bought the contents of 'The Sentimental Library' from Harry B. Smith, in May 1915, for the sum of $79,000 (4). As Rosenbach did not have sufficient funds, he borrowed money from William M.Elkins (5). Consequently, Elkins was entitled to the first choice of the items in the collection (6), *"Bill Elkins bought curiosities like Dickens' letter scale, candle-lamp and writing desk"* (7).

FIG 2.



When Elkins died in 1947, he bequeathed his library to the Free Public Library of Philadelphia, Pennsylvania, where the William M.Elkins Room was dedicated in 1952. There, in a room arranged just as it was in his home in Elkins Park, the Dickens' candlestick scale is diplayed for all to see.

NOTES

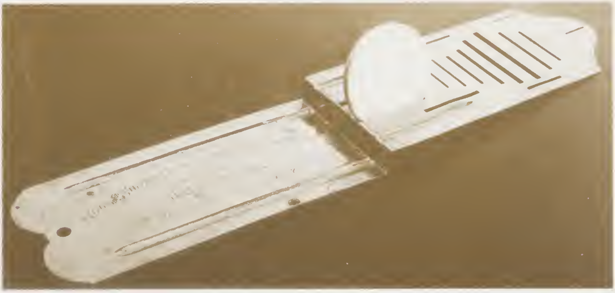
1. Lecture 13 Jan. 1983; Howell Heaney, Philadelphia.
2. Letter, 16 Jul. 1984 from S.J.Wiseman, Dickens Museum, London.
3. From 1894 to 1914, Harry B.Smith "who had made his reputation in the theatrical world, had for twenty years been gathering a collection of books and other items". Wolf & Fleming *'Rosenbach - a Biography'* New York 1960, p.89. Smith's catalogue was printed by DeVinne Press, 1914.
4. *'Rosenbach - a Biography'* ibid pp.538-539. Rosenbach was a dealer in rare books who purchased the original autographed manuscript of Alice in Wonderland, in 1946, for $50,000.
5. Agreement and note dated 7 May 1915 in the files of Rosenbach Library and Museum, Philadelphia, PA.
6. Conversation with Edwin Wolf 2nd, retired Librarian, Library Company of Philadelphia.
7. *'Rosenbach - a Biography'* ibid p.102.

ACKNOWLEDGEMENTS

Special thanks for assistance go to Patricia Willis, Curator, Rosenbach Library and Museum; Marie Elena Korey, Head Librarian, Rare Book Dept. Free Public Library of Philadelphia; and Howell Heaney, retired Head Librarian of the same Dept.

American Patent CCDs

A SERIES ON COUNTERFEIT COIN DETECTORS GEORGE MALLIS



A flat plate was bent into the form of a 'Z' with one leg flat on a table or other horizontal surface, and the other parallel leg raised above the surface. The raised leg was slotted for testing the size and weight of the coins. Genuine coins will tip the device down, while lightweight coins will not. (This CCD was made by the Berrian Manufacturing Co. and could also weigh letters in a later modification - see LETTERS, p.848 - Editor).

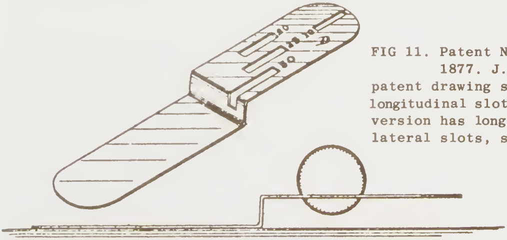


FIG 11. Patent No.187936. 27 Feb 1877. J.A.Thompson; The patent drawing shows only the longitudinal slots. The production version has longitudinal and lateral slots, see Fig 10.

Cummings' rather ingenious device employs a simple movable weight which, instead of sliding on the beam like a steelyard, swings horizontally around a pivot on the beam. The weight is supported by an arc which is marked with the position to which it must be turned to balance each coin. The clip is made to hold a letter, as an alternative to a coin, so the arc is also graduated in ounces. Strictly speaking, this is not a CCD, as it will only weigh the coin, and cannot gauge its diameter or thickness.

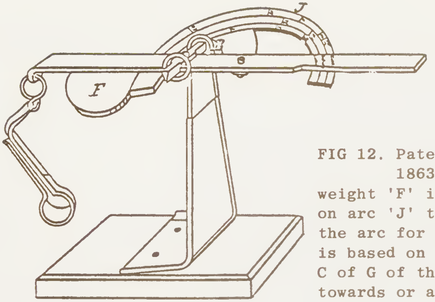
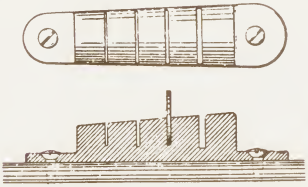
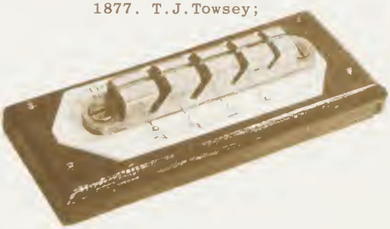


FIG 12. Patent No.39890. 15 Sep. 1863. D.Cummings; The weight 'F' is rotated horizontally on arc 'J' to the relevant mark on the arc for the coin. The principle is based on a steelyard. i.e. the C of G of the weight is moved towards or away from the fulcrum.

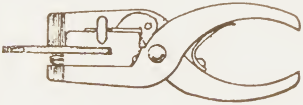
Towsey's unusual device depends upon the bending or breaking of the suspected coin to determine its genuineness. It consists of a piece of cast iron fastened to a wooden base. In the iron are slots of different widths for all the U.S. gold and silver coins current at the time of the patent, and the depth of the slot is based on the radius of the coin to be checked. The coin is placed in the appropriate slot and then pushed against the side, the theory being that a false coin of base metal would be bent or broken if pushed hard enough ! No weighing was involved.



◄ FIG 13. Patent No. 187938. 27 Feb. 1877. T.J.Towsey;

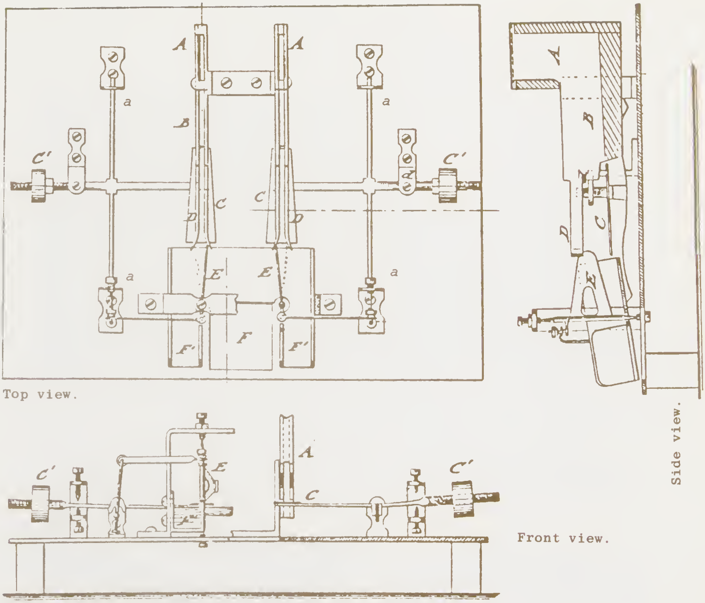


▲ FIG 14. British tester like Towsey's, but tests silver coins 2s 6d, 2s, 1s, 6d.



◄ FIG 15. Patent No.188637. 20 Mar. 1877. George M.Hopkins;

Hopkins' invention is described as a clamping device to hold the suspected coin and a spring-actuated hammer with which to strike it. From the sound or timbre of the struck coin the observer is supposed to determine if the coin is genuine or counterfeit. Again, this is not a true CCD, and no weighing is involved. The strange part of this patent is that what is accomplished by the clamp and hammer can just as easily be done by simply dropping the coin on any convenient hard surface.



Top view.

Side view.

Front view.

FIG 16. Patent No.183833. 13 Oct. 1876. A.Bernstein; This apparatus was fixed to a shop counter with the slots 'A' through the counter top. Key to the parts :-

A - slot for the coins.
B - vertical guides for the rolling coin.
C - weighing plate on beam.
C' - weight on beam.
D - extended guides.
E - gate for coins.
F - chute for bad coins.
F' - chute for good coins.
aa - beam fulcrum.

Bernstein's apparatus had a slot in the counter for each denomination of coin to be checked. The slots were of such width and length that only coins of proper diameter and thickness would pass through. Once through the slot, the coin rolled between vertical guides and onto a rocker weighbeam. If the coin was light it did not tilt the beam, and so it passed on to an inclined plane and into a receiver of false coins. If the coin was of correct weight, the beam tilted down, and by a linkage system moved a gate to allow the coin to pass through a further slot into the till.

Precision Balance 11

HANS JENEMANN

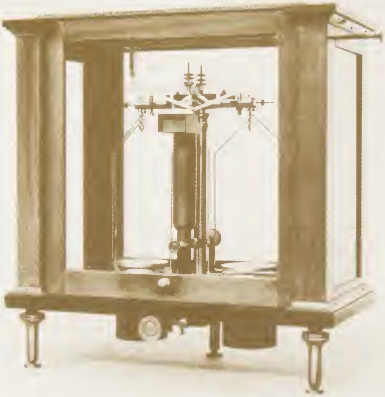


FIG 1.

This analytical balance, Fig 1, was made by Becker's Sons in Brummen in the Netherlands, c.1930. It is equipped with optical projection, combined with air-damping in the base-plate, as constructed by Pierre Curie in Paris (see Precision Balance 7). The instrument is a relatively early example with optical projection. In the period after 1930, this attachment began to gain acceptance more and more, and later on, all analytical balances were fitted with this means of weight indication.

Becker's Sons' balance is fitted with rider equipment for the range of 0.1 to 1.0 gram. The divisions begin at the left side of the beam and continue across to the right, thus gaining a better accuracy for the use of a 500mg rider (compare with Precision Balance 7 and 10). The micro-scale is divided from 0 to 100 from the middle to the left and to the right, but only a little part of the scale can be seen at a time. Each mark indicates one milligram, and between each two marks the half is shown, Fig 3. As it is possible to estimate between these half marks, one fifth of the distance, the balance is able to indicate 0.1mg. In a catalogue of Becker's Sons, of c.1932, it states that a nonius division could be fitted to the ground glass, making it possible to indicate 0.1mg directly. Fig 2 shows a longitudinal section of the principle used for the optical projection system similar to that used in later times. The lamp, commonly 6 volt, was attached to the outside of the balance case to allow the heat to disperse. When making a very sensitive instrument, such as a micro-balance, additional protection was added in the form of a glass heat-filter.

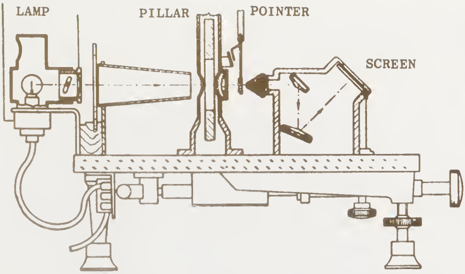


FIG 2. (left) Optical projection system with electric lamp.

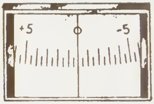


FIG 3. Scale.

The case of Becker's Sons balance measures 430 x 230 x 450mm high (17 x 9 x 17.7"), and the length of the straight beam is 160mm (6.25"). All the other parts are normal components of analytical balances and don't need further description. With this balance, rapid weighing could be achieved without using the, so-called, "broken weight", i.e. the weights under one gram. Only weights beginning with one gram upwards to 200 grams had to be put in the pan. The range from 0 to 0.9 was served by the rider arrangement, and the residual range to 0.1mg could be read quickly by the optical projection system, when the beam came to rest.

The firm Becker's Sons was founded in 1872, in Rotterdam, by two of the four sons of Christopher Becker. In 1914, a new factory was established at Brummen, near Arnhem. In 1926, the name of the firm was changed to N.V.Hollandsche Optiek Fabriek (System Hensoldt). In 1949 the name was changed again to Fijn-mechanische Industrie Becker's Sons N.V. Then, in 1968, the name of Becker disappeared when the firm was taken over by another company, and it became Simmonds Precision N.V. This firm has a factory and a trading company selling instruments, tools and other technical articles. The production of precision balances has since been brought to an end.

* * *

Making Scales

ILLUSTRATIONS SUPPLIED BY
HERBERT GRIESSHABER
COMMENTS BY MICHAEL CRAWFORTH

The following illustrations show the workshops of the Schnellwaagen-Fabrik G.M.B.H. of Karlsruhe, Baden, Germany, in the 1930s. Fan scales and over-and-under scales made by this company are shown in Figs 1 & 2. The new development of this type of scale was enthusiastically received by shop-keepers of the 1930s, and the photographs give an excellent idea of the large number of scales that such a factory needed to produce to employ so many men. They indicate the large demand from an expanding economy, after the acute depression of the late 1920s.

FIG 1. FAN SCALE: A quick-reading scale using the pendulum (inclination) principle. The fan is graduated 0 - 1000 gm.

FIG 2. OVER-AND-UNDER SCALE: A weight is placed on the left-hand plate, and the pointer reads zero at the centre if the goods are of equal weight. If the goods are heavier, or lighter, than the weight on the plate, the pointer indicates up to 500 gm. over or under.

FIG 3. DRILLING SHOP: The man in the foreground is drilling side-frames for the scales. A pile of fan casings is stacked on the left. Overhead, a long shaft supplies power via a series of belt-drives, to operate all the machines - a factory inspector's nightmare !

FIG 4. HARDENING SHOP: The furnaces on the left were used to heat the pivot knives and bearings to red heat. They were then plunged into the tank in the centre to harden the steel. In this state they would be very brittle, so the man at the tank is taking them out and putting them on a tray ready for tempering. This involved further heating to a predetermined temperature prior to final cooling. The man on the right is probably filing knives to a near-finished state.

FIG 5. SUB-ASSEMBLY: The man on the left is assembling twin beams of the type used in the over-and-under scales, Fig 2. Behind him, men are aligning the beams and knives on assembly jigs. On the right, a man is filing small parts, and behind him other men are assembling fan casings.

FIG 6. QUALITY CONTROL: In the foreground, a man is inspecting castings and rejecting any which do not meet the company's standards. Behind the fence, men are using lathes and other machine tools to make component parts for the scales.

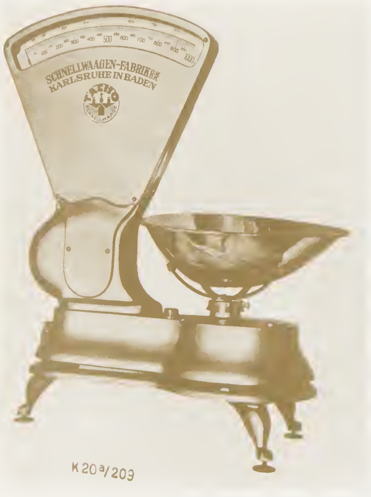


FIG 1.

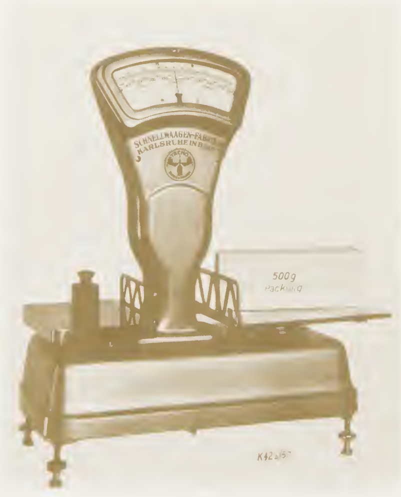


FIG 2.

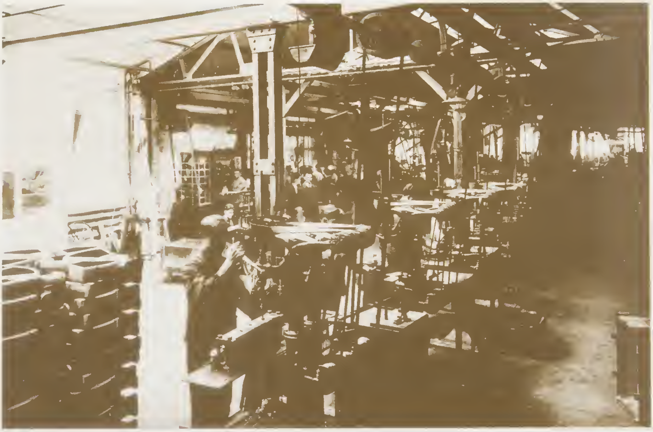


FIG 3.

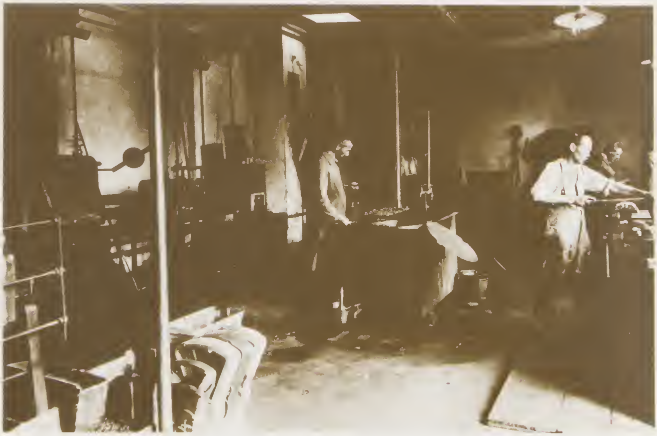
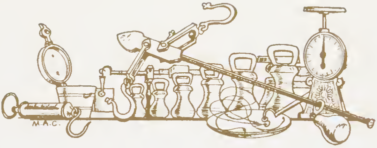


FIG 4.

FIG 5.

FIG 6.

Letters



KITCHEN SCALES

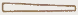
Your article on kitchen scales was most interesting and I thought the following might be of some interest to you.

Some years ago, Ruth came across a kitchen scale in a museum in Richmond, Virginia, and made the following notes: Kitchen Balance - hand beaten copper pans, mid-1800s, for weighing small quantities of flour, sugar, spices etc. Old-time recipes might call for the weight of four eggs in sugar, or flour or butter. The eggs would be put in one pan and balanced with an equal amount of flour, then with sugar, then butter. No weights were necessary. Spices, etc, were called for by ounces and were weighed using weights. We believe this was the origin of the "Pound cake".

Lewis Stern Weiss.

COINS AND LETTERS

In a recent Equilibrium you asked for further data on American coin scales. You illustrated the Berrian CCD (EQM p.754) with 8 crosswise slots to test the thickness and diameter on a drop-through basis. These are uniformly spaced as they do not relate to weight. The 8 longitudinal slots are the same thickness, but are shorter in length so that the coin will stand vertically in the appropriate position for weighing. To have separate slots for these two functions (size and weight) is unusual, I believe. The first version of this scale was only for coins. A later version was provided with additional markings of ½, 1, 2 oz, crosswise, to weigh letters. The question I raise is how these markings were used ? I conclude that the letter had to be placed on edge standing vertically across the detector, on the mark selected. To hold it in that position to see if it tilted the rocker, I can only conclude that it was held loosely between finger and thumb. I was quite amused to note the simplicity and crudeness of this adaptation.

The Thompson CCD which you illustrated (EQM p.763 Fig 1) also has curiosities. My example has stamped upon it PAT.APL.3,77 which means April, not 'Applied', perhaps. Under that is IMPROVED JAN.5,78. Below that on the other side of the strengthening rib is, in a curved line, PAT FEB.24,80. Another curiosity is that it has four legs, so that it has two fulcrum positions depending on whether the coin being tested is on the right side ($20, $10 gold; $1, 50¢ silver) or on the left side ($5, $2.50, $1, gold; 25¢. 10¢ silver). The next surprise is the wedge-shaped slots:  The only possible advantage I can guess is that it was easier to drop the coin into the slot by inserting it near the wide end, perhaps to help those who could not see well or who had nervous fingers.

Eric Newman.